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Policy paper 8: Urban ecology and resilience*

Note by the secretariat

The secretariat of the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) hereby transmits a policy paper entitled "Urban ecology and resilience", prepared by the members of Policy Unit 1.

Habitat III policy units are co-led by two international organizations and composed of a maximum of 20 experts each, bringing together individual experts from a variety of fields, including academia, government, civil society and other regional and international bodies.

The composition of Policy Unit 1 and its policy paper framework can be consulted at www.habitat3.org.

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Policy paper 8: Urban ecology and resilience

Executive summary

As the global population becomes increasingly urban, the design, planning and management of cities become more important to human health, well-being, and quality of life. Inevitably, urban ecology, urban environmental sustainability, and resilience are central to this shift.

This paper argues that we should work towards a future that is environmentally sustainable, with ecologically healthy, low-carbon, resource-efficient, and resilient cities that have the ability to mitigate and adapt to a variety of shocks and stresses. The policy recommendations and implementation proposals outlined in this paper advocate for a participatory and inclusive urban planning and design process that will help make this vision a reality. Incorporating environmental challenges into decision-making is a way to improve quality of life of citizens and increase cities' competitiveness.

Challenges

In the development of this policy paper, two key challenges related to urban ecology and resilience were prominent in discussions of the experts and co-leads. First is the need to change the way we think of cities. The city is primarily perceived as a significant source of negative ecological impacts. But we need to harness the amazing potential that cities have to spark and spur new technologies, practices and approaches that help achieve local and global environmental goals. Cities are hubs of innovation and their density of population provides economies of scale to reduce environmental impacts such as greenhouse gas emissions per capita (McGranahan and Satterthwaite 2014). To maximize the multiple benefits of the compact city form, a paradigm shift is needed in the way that cities are shaped and governed.

The second challenge identified in discussions is the need to review and revise the way we live in, design, and manage our cities. Shocks and stresses affecting cities now and in the future pose significant threats to humans and ecosystems. In many cities, potential shocks — such as extreme weather events related to climate change — are not yet being sufficiently addressed through infrastructure and institutional development. Similarly, stresses, which may be slower to manifest but equally damaging, such as insufficient water supply, poor air quality, and shortages of natural resources due to unsustainable consumption and production, are also not incorporated in the design and/or management of cities. City design, planning and management decisions need to be based on a longer-term vision.

Policy areas

Most cities lack the resources and capacity to effectively tackle the specific barriers to urban environmental sustainability and resilience. This paper identifies policy areas that are critical to building the vision espoused in this document.

Current literature points towards a lack of understanding of resource flows and patterns of consumption and production as one of the barriers to urban environmental sustainability. There is also a need to develop locally appropriate ways to protect and support ecosystem health. Examples include investment in

green infrastructure and nature-based solutions, provision of diverse open space, a shift to reliance on renewable energy sources, and improved options for transport such as walking, cycling, and mass transit.

Lack of a thorough understanding of risks and vulnerabilities is a barrier to resilience. By using tools such as hazard assessments for relevant current and future stresses and shocks, cities can then design and implement measures that will prevent or mitigate the impacts of disturbances. Fundamental aspects of resilience such as redundancy of urban infrastructure, flexibility of urban space, and inclusive communities should all be integrated into urban planning and management.

Cross-cutting systemic challenges also hamper the formulation and implementation of policies that promote urban environmental sustainability and resilience.

Challenges of governance include the interdependence of different levels of government (e.g. neighbourhood, city, state, national, regional, and global). Institutions often struggle to find ways to work effectively and efficiently with others at different levels. Vertical and horizontal policy integration will be critical.

At the global level, common indicators (e.g. shared between the Sustainable Development Goals, the Sendai Framework for Disaster Risk Reduction 2015-2030, and potentially the New Urban Agenda) are expected to improve comparability and reduce the reporting burden on cities, but this has yet to be implemented by a broad range of stakeholders.

Participation of the broader population and particularly the inclusion of marginalized groups such as women, youth, and indigenous peoples is also a key issue. Engaging with the most substantial cross-cutting set of power relations that shape the different experiences in and influence on the urban environment is critical to achieving urban environmental sustainability and resilience.

The role of knowledge management and access to information is another cross-cutting concern. Additional research and analysis is needed to help shape and inform policies on urban environmental sustainability and resilience. A design approach which foregrounds the local is a powerful but underused tool to address environmental improvements that can be co-beneficial to the everyday lives of people and to strengthen their resilience in case of shocks or stresses. Education and awareness-raising are also essential so that urban residents of all ages can become active participants in the co-creation of a healthy, resource-efficient and resilient city.

A New Urban Agenda

Policy paper 8, on urban ecology and resilience, explores the challenge of managing both environmental and human well-being, and the critical role of cities in meeting this challenge. It proposes that a city can be designed and managed to provide multiple benefits that contribute to quality of human life while improving resource efficiency and reducing overall environmental impact.

The authors of this paper recognize that policy paper 8 is only one of many inputs to the New Urban Agenda, and several distinct policy elements are needed in order for us to achieve global goals. Thus, other policy units and issue papers produced through the Habitat III process are referenced throughout this document.

Issue papers 14 (Urban resilience), 15 (Urban ecosystems and resource management), 16 (Cities and climate change and disaster risk management) and 17 (Urban infrastructure and basic services, including energy) are key references for this policy paper. Particularly relevant themes include social equity and inclusion (Policy Units 1 and 2; issue papers 1 and 2); urban spatial strategies (Policy Unit 6, issue papers 8, 9, and 10), and the long-term economic implications of continued growth (Policy Unit 7).

I. Vision and framework of the policy paper's contribution to the New Urban Agenda

1. By 2050 there will be about 9.7 billion people sharing the Earth's resources, 66 per cent of whom are expected to live in urban areas (UNDESA 2014; 2015). With this growth in urban population and expansion of cities, the relationship between human settlements and ecosystems is increasingly vital, both in terms of environmental sustainability and vulnerability to shocks and stresses.

2. Policy paper 8, on urban ecology and resilience, explores the challenge of managing both environmental and human well-being in this context, and the critical role of cities in meeting this challenge. It proposes that a city can be designed and managed to provide multiple benefits that contribute to quality of human life while improving resource efficiency and reducing overall environmental impact. The paper recognizes opportunities for change that will build on the distinct challenges of diverse cities in developed and developing countries, which vary in size, form, physical and cultural context, and level and types of vulnerability.

3. Applying the "urban ecology and resilience" frame demands a long-term view where cities examine their consumption patterns and the flow of key resources (e.g. food, water, waste, building materials, energy) in the specific dynamic contexts of local environment, society and culture. Resilience thinking also encourages us to both anticipate and respond to pressures and threats in ways that can improve the short- and long-term well-being of humans and ecosystems.

A. Urban ecology and resilience

4. This paper considers the concepts of urban ecology and resilience as fundamental to well-being and transformative change. The two concepts are inherently intertwined — indeed resilience thinking emerged from ecology and the principle that cities are unique and complex systems. It is this systems thinking that Policy Unit 8 views as essential to creating cities that meet the life and livelihood needs of all of their citizens (see annex I, Glossary for the definition of systems thinking used in this paper). Through a systems approach, stresses and shocks can be evaluated holistically to understand which pose the greatest long-term threats to the health of cities and their habitants — such as climate change, energy demand, social cohesion, economic stability, governance, access to natural resources (especially water), and population growth.

5. Urban ecology is the systems-based understanding of biotic and physical elements that occur in urban areas. It recognizes the interactions between natural systems and social and cultural systems, among others. Urban ecology places

particular importance on the primacy of natural systems in contributing to livelihoods, well-being and resilience, and focuses on the interdependence of key resources (such as food, water and energy) and their impact on city development.

6. In discussions related to the development of this policy paper, the experts and co-leads found it necessary to include a broader discussion of environmental issues linked to sustainability, which will be a critical element in the New Urban Agenda. "Sustainable" is defined as the state wherein natural systems function, remain diverse and enable the ecosystem to remain in balance. Urban environmental sustainability often refers to the outcomes of policies and actions that arise from urban ecology.

7. Resilience is a complex and dynamic system-based concept used differently in a variety of disciplines, and also a simple concept referring to the ability of a system to return to a previous or improved set of dynamics following a shock. It also refers to the potential for individuals, communities, and ecosystems to prevent, absorb, accommodate and recover from a range of shocks and stresses. At the urban scale, resilience requires investment in man-made and nature-based "hard" infrastructures, as well as "soft" systems such as knowledge and institutions. The concept of resilience when applied effectively can provide a useful base for more substantial changes in the underlying social, political and economic drivers of risk and vulnerability.[1] Factors that influence resilience of cities include their organizational structures, functions, physical entities, and spatial scales. A resilient system can continually survive, adapt and grow in the face of resource challenges and disturbances in an integrated and holistic manner for the well-being of the individual and collective. Those challenges and disturbances may be discrete and temporary, such as a natural disaster, or endure over a longer period, such as a shift in climate conditions or change in availability of key resources.

8. The concepts of urban ecology and resilience are framed by the interrelationships between communities and the natural and built environments at local, regional and global scales. The dynamic between these changing entities is fundamental to resilience thinking and underpins the intentions of resilience: to understand and strengthen a city's capacity to mitigate, adapt to, and recover from internal and external shocks and stresses.

9. The outcomes of improving urban ecology and resilience invariably have multiple benefits, which cut across society, culture and environment. For example, zones within a city that are prone to flooding can be transformed into protective green infrastructure that manages flooding and becomes an important source of locally grown food or water, or a recreational space that enhances community ties and physical and mental health.

10. Urban metabolism, urban nexus, productive cities, regenerative cities, resource-efficient cities, nature-based solutions and low-carbon cities are all concepts related to urban ecology, urban sustainability and resilience. All of these emphasize the need to articulate viable pathways for transitioning urban economies to achieve improved well-being and environmental justice by transforming

[1] The Inter-Governmental Working Group on Indicators and Terminologies is reviewing the definition of resilience as stated in the "Working Background Text on Terminology for Disaster Risk Reduction".

dependence on non-renewable materials to more resource-efficient and renewable flows and better management of ecosystems.

B. Relationship to global policy processes

11. This paper's discussion of urban ecology and resilience is relevant to the achievement of the United Nations Sustainable Development Goals. The Sustainable Development Goals underscore the importance of joint action — including by local governments — to address global environmental issues. While all the Goals have important links to the topic of this Policy Unit, thematically, the discussion in this paper is most relevant to Goal 2 on food security; Goal 3 on health, Goal 6 on sustainable management of water; Goal 7 on sustainable energy sources; Goal 9 on resilient infrastructure; Goal 11 on sustainable and resilient human settlements; Goal 12 on sustainable consumption and production; and Goal 13 on climate change (see sustainabledevelopment.un.org/sdgs).

12. In addition, the Sendai Framework relates specifically to resilience by providing a global blueprint for managing disaster risks (see unisdr.org/we/coordinate/sendai-framework). Its first four targets: to reduce (a) mortality, (b) affected populations, (c) economic losses, and (d) damage to critical infrastructure, also align closely with several targets of the Sustainable Development Goals. Both the Sustainable Development Goals and the Sendai Framework principles and approaches to adaptation are fully embedded in the Paris agreement adopted at the twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21).

13. This paper builds on the gains of COP21, which speak to a change in the way we invest in infrastructure and shape our cities. Policy recommendations in this paper support COP21 targets such as the decision to invest in renewable energy for 78 per cent of new power generation investments by 2030 in major economies (Mabey et al. 2016). COP21 also reached crucial agreements on issues such as national contributions to mitigation and global financing for adaptation measures, which set out guidelines and resources for cities investing in ecological health and resilience.

14. The paper is also in continuity with the broader process towards sustainable urban development. It is in line with the Istanbul Declaration on Human Settlements (Habitat II), that emphasizes parties' commitment "to sustainable patterns of production, consumption, transportation and settlements development; pollution prevention; respect for the carrying capacity of ecosystems; and the preservation of opportunities for future generations [...] in order to sustain our global environment and improve the quality of living in our human settlements".

C. Vision: sustainable and resilient city

15. Habitat III is an opportunity to reimagine our cities and this paper attempts to articulate a vision of the future city in this section. This vision was developed with a common understanding that cities need to be seen from a holistic perspective — physical, governance, economic, cultural, and societal systems.

16. Considering the environmental and socioeconomic challenges the world faces today, it is imperative that the city of the future be environmentally sustainable and resilient since this is crucial to maintaining and promoting overall quality of life. With this in mind, we envision that:

(a) The city of the future will be the product of conscious investments of the cities of today to build infrastructure and good urban form that promotes accessibility, equality, mobility and cultural identity. Participatory processes will be used, accessing the knowledge and experience of all residents, to design and transform cities. Because of the key role they play in urban life, women will have equal opportunity to participate in decision-making;

(b) The city of the future will be structured to minimize the adverse impacts of the city's overall consumption and production on ecosystems within and beyond its borders, and to contribute to meeting regional and global sustainability goals. It will optimize the sustainable use of environmental resources and mitigate and manage climate change impacts;

(c) The city of the future must be built in consideration of global environmental changes so that it is capable of adapting to, mitigating, and preparing for the various shocks and stresses it faces. These include new and re-emerging diseases, changes in food sources and food security, insufficient quantity and quality of water resources, more frequent extreme weather events, sea level rise, loss of biodiversity, and population pressures from migration;

(d) The future city will have nature-based infrastructure that not only provides a broad range of ecosystem services, reduces pollution, and improves contact with nature, but also provides opportunities to strengthen social cohesion. It will be a city that protects and conserves water resources, is fuelled primarily by renewable energy, and is able to meet growing demands in an environmentally sustainable, cost-effective, resource-efficient and secure manner.

17. To realize the vision of the sustainable and resilient city, there needs to be a global paradigm shift. City leaders, practitioners, city residents, and national leaders need to embrace systems thinking and recognize the interdependencies and interconnections across physical scales and between policies, actions, and effects. There needs to be a conscious effort to introduce this thinking into local practices and education systems.

18. Policy Unit 8 also supports the vision of Policy Unit 7 that argues for cities to consciously address issues of social equity and long-term economic development. A cross-cutting approach will ensure that these issues are addressed in an integrated manner, so that the visions and actions do not conflict. This Policy Unit also references Policy Unit 3, which emphasizes integrated planning, and policy. The future city should integrate planning at various scales — plot, neighbourhood, district, city boundaries, city region, national, regional and global — as all of these will affect sustainability and resilience. Legal and institutional development, governance and policy coordination (Policy Units 3 and 4) should accompany technological innovation towards strengthened resilience, increased community participation and responsibility, and reduction of environmental impact. Recommendations of Policy Unit 6 on integrated spatial planning and management, including rural-urban linkages, appropriate land tenure systems, and access to safe

and inclusive green and public spaces are also closely linked to Policy Unit 8 priorities for improved urban ecology and strengthened resilience.

II. Policy challenges

19. The policy challenges and priorities outlined in the next two sections are categorized into two types: those specific to urban ecology/urban environmental sustainability and resilience which address particular tangible physical, social, institutional or economic outcomes; and cross-cutting process-oriented subjects which address challenges and priorities of urban ecology and resilience, and are also critical to other aspects of the New Urban Agenda. Notwithstanding the enormous diversity that exists from city to city and within the local conditions of cities, there are certain outcomes described in sections II and III of urban ecology/urban environmental sustainability and resilience, which are broadly shared, and can benefit from common tools, such as the use of nature-based solutions and disaster risk assessments. At the same time, to ensure relevance for a global audience, many of Policy Unit 8's recommendations relate to cross-cutting measures that should be in place to ensure, for example, effective governance, inclusivity, and use of design thinking, in order to help every city to develop appropriate local strategies. Implementation (as discussed in sect. IV) suggests ways to integrate tangible solutions and cross-cutting measures to ensure local relevance and efficacy.

A. Challenges to urban ecology and resilience

20. Cities face a number of challenges to their capability and capacity to provide healthy and resilient habitats for humans over the long term.

21. Potential shocks have a wide range of natural and social causes, from increased annual flooding to massive global migration, an issue discussed in detail in issue paper 2 on migration and refugees in urban areas.[2] Today, a large share of the global urban population is also highly vulnerable to environmental hazards, such as extreme climatic events resulting in increasingly frequent and intense droughts and floods, sea level rise and storm surges, and extreme heat; or other natural hazards such as earthquakes, tsunamis, landslides and flash floods. A heavy reliance on distant sources for energy, water, food, and goods has also made some cities vulnerable to sudden disruption of supply.

22. In addition to unpredictable and sudden shocks, cities also need to cope with numerous forms of stress. Consumption and production patterns exceeding the ecosystem's regenerative capacity and planetary boundaries cause resource depletion both within and outside the immediate urban area. Land-use change and land degradation patterns affect local and regional climatic and ecosystem patterns, reducing resilience and causing irreversible ecosystem damage. Air, water and soil are contaminated due to ineffective waste management systems, affecting human health and ecosystem function. Most cities rely primarily on unsustainable energy sources to meet daily residential and industrial needs, resulting in indoor and

[2] Issue paper 2 argues that "planning for and effectively managing migration and displacement is critical to promoting productive, socially inclusive, resilient and sustainable cities" (p. 4).

outdoor air quality deterioration, and a major share of contributions to global greenhouse gas emissions.

23. When considering how to deal with shocks and stresses through policy and planning approaches, policymakers and urban populations are forced to balance competing values such as economic growth, equitable distribution of resources, protection of cultural heritage, resource efficiency, and affordable housing and transport, alongside urban ecology and resilience.

24. It does not help that shocks and stresses are often exacerbated by other issues such as inexorable growth: cities are expanding in places and in ways that ignore or deflate the risks and thereby compound the vulnerabilities. Governance inertia and incapacity is another common issue that aggravates the impact of shocks and stresses. Lack of skills and knowledge, economic instability and the absence of participatory mechanisms magnify these challenges. Often, short-term political cycles or short-sighted economic motives mean that policies and actions do not prioritize a healthy urban ecology. Likewise, conditions are not always right for choices to be made that require an upfront investment, which can generate significant savings in terms of financial and economic returns and protected lives and livelihoods, or a resilience dividend.[3] A range of short- and long-term consequences of climate change complicates the situation even further. They cause physical and financial damage and have negative impacts on human health and well-being, on infrastructure and buildings, and on the health of ecological systems.

25. Due to the numerous barriers faced by city practitioners,[4] the increased exposure and vulnerability of urban populations to shocks and stresses has often been inadequately addressed through infrastructure and institutional development. Today, the planning of resources and capacity to prevent and prepare for damage through early warning and response systems varies. Infrastructure and systems to deliver accessible, reliable, resource-efficient services that are resilient to disasters and a changing climate are often inadequate. Increasing inequality among urban populations causes disproportionate impacts on the most vulnerable and damages the resilience benefits that arise from social cohesion.

26. In spite of these challenges, cities also offer enormous opportunities. In the last decade a growing body of research has demonstrated that urbanization is a key driver of sustainable development. The concentration of people and economic activities that characterizes the urban form allows for major economies of scale; it facilitates the spread of knowledge, culture, and ideas; and it leads to technological and social innovation. At the same time, there is more and more evidence that cities, if adequately managed, also provide significant opportunities to enhance people's resilience and reduce their impact on the environment. While in absolute terms, cities are today a major source of ecological problems, a paradigm shift in the way

[3] The "resilience dividend" has two components: (a) the difference between how disruptive a shock or stress might be to a city that has made resilience investments compared to where that city would be if it hasn't invested in resilience; (b) the co-benefits that investing in resilience can yield to a city that can include job creation, economic opportunity, social cohesion and equity. To realize a resilience dividend, upfront investments are required both in terms of financing and resources. The "resilience dividend" is an "economic leg-up" and allows the city to prepare for the next shock and unknowable circumstances (Rodin 2014).

[4] City practitioners are those involved in policymaking and planning at the city level including but not limited to local government officials, national-level bureaucrats working on city issues, NGOs, and research institutions.

cities are built and governed carries a potential that goes far beyond urban areas. Harvesting this potential of cities to achieve local and global objectives of sustainability and resilience is probably the greatest endeavour of the twenty-first century (among others, see McGranahan and Satterthwaite 2014).

B. Cross-cutting challenges

27. To effectively address the challenges presented above, policymakers must consider and tackle the system- and process-related factors that have contributed to creation of those challenges. While these issues may broadly characterize the overall governance of cities, they are also particularly relevant to the policy processes related to urban ecology and resilience.

Interdependencies of governance

28. The scale of urban ecology and resilience challenges and risks tend to cut across national, regional and metropolitan boundaries, as environmental units of scale such as watersheds do not align with administrative units of governance. This requires coordinated intervention at multiple levels of government, by adjacent administrative units, and by different types of actors, including non-governmental actors such as businesses and individuals. But there are a number of issues that prevent this coordination: appropriate administrative frameworks and mechanisms for cooperation are often missing, making it difficult to achieve a coherent policy intervention, and leaving potential for conflict or gaps in areas of coverage, responsibility and liability; local authorities and local communities often lack the decision-making authority and resources to address their own unique challenges, and may be reliant on state or national guidance or funding; significant differences exist between cities of varying size, age and level of income makes national policy difficult; and, in fast-growing cities, governance frameworks and mechanisms are not always in place, resulting in a decrease in the capacity to plan for the long term and to develop appropriate hard and green infrastructure.

Local participation and inclusion

29. Within cities and communities, there is often limited involvement of diverse local actors in the policy process associated with urban ecology and resilience. This is in part due to the greater economic inequalities in cities (discussed at length in Habitat III issue paper 1 on inclusive cities). Local participation is key to understanding local issues and local landscapes, which are fundamental to the interdependent scalar dimensions of resilience. Of particular concern is the limited input by women, the poor, youth and elderly, physically or mentally disabled, migrants, minority indigenous peoples and others, who are typically the most vulnerable to environmental stresses and shocks, but who also often have insightful perspectives on resilience. Exclusion of private sector actors from the policy process also potentially undermines access to additional knowledge and resources. As a result policies fail to effectively address and prioritize concerns and risks, and may actually increase inequality and environmental injustice. Without mechanisms to enable inclusive and broad-based participation, especially by women and other marginalized groups, policymakers will struggle to gain buy-in and risk failure of implementation.

Knowledge and capacity

30. Limited knowledge about urban ecology and resilience represents a significant challenge, and slows down the process of change and the feedback loops that are essential to resilience. Policymakers and practitioners often do not have an adequate understanding of the principles of systems thinking, and lack a detailed knowledge of the specificities of the local context, e.g. the vulnerability of infrastructure, the built environment, cultural identity, social cohesion, and resource flows and dependencies. Limits of capacity also hold back progress. Urban managers and policymakers need resources to create and implement effective policies towards sustainability and resilience at a neighbourhood and local scale as well as the national scale. Local communities and individuals, in turn, often do not have the capacity to effectively engage in the policy sphere.

Design integration

31. Traditional planning approaches are typically reductionist, single-sector, and linear and do not consider the complexity of interactions in an urban system, which can lead to unintended consequences. Without a systems-oriented approach, such as a local bottom-up design approach that simultaneously addresses physical, cultural, societal and economic issues, urban areas are often not understood as part of their surrounding context, or in terms of the flows of resources, people, water and energy. Ignoring resource flows and the interdependence of urban, peri-urban, and rural areas, as well as the relation between a city and its natural environment, can lead to policies which reinforce and enforce unsustainable resource use. Often, a lack of planning tools and current data makes integration of the design approach into planning and policies challenging.

III. Prioritizing policy options: transformative actions for the New Urban Agenda

32. Meeting the challenges outlined above requires a paradigm shift in the way that cities are perceived, shaped, and governed. City systems must be transformed to encourage healthy, sustainable life and enable the development of communities that can adapt to and prepare for existing/potential shocks and stresses.

33. This paper recommends prioritizing policies that push for a significant change in physical outcomes and can be catalysts of a broader policy process. Ultimately, policies must address the related but distinct goals of a healthy urban ecology and strengthened resilience.

A. Outcome-related policy recommendations on urban ecology and resilience

Optimize urban subsystems and human health

34. Effective management for urban environmental sustainability and resilience potentially provides multiple benefits including economic development, more attractive and liveable urban landscapes, and increased human well-being. These are

elements to a thriving urban subsystem[5] and to what is often referred to as a "healthy city" referring mainly to the positive impacts on human health. Specific policy recommendations to achieve both are as follows.

35. Investment in infrastructure is paramount in optimizing the urban subsystem and prioritizing human health. A key approach would be introducing nature-based solutions into cities.[6] Some key aspects of this are:

(a) Utilizing an integrated "blue-green" approach to water resource management (including black, grey and storm water) and the design of urban green space;

(b) Revaluing and restoration of degraded ecosystems and remediation of contaminated air, water and soil. This will include monitoring air, water, and soil quality and adopting measures to reduce pollutants and particulate matter;

(c) Targeting water quality in coastal and riparian areas is especially important;

(d) Protecting and increasing biodiversity in cities;

(e) Minimizing pollution through effective chemical and waste management, minimizing urban heat island effect and street canyon effect on air pollution;

(f) Providing diverse open and safe public green space which enables cultural, community and recreation activities, and contributes to food and water security.

36. Social systems are also critical to successful nature-based solutions. It is thus important to regularly collect and analyse data on the interaction of ecological and social systems to better understand relationships and "tipping points". Policies should focus on:

(a) Understanding how cities and all their citizens depend on specific resources, measuring urban metabolic flows, and identifying options to promote a more effective and sustainable use of natural resources;

(b) Reducing the production of noise, odour, radiation and vibrations which negatively affect human and ecosystem health.

37. Climate change is among the key challenges that cities face in the twenty-first century. Many of the problems associated with climate change can be addressed at the city level by promoting a low-carbon agenda. This includes:

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[5] The urban system is characterized by the presence of many essential, interrelated elements within a complex structure. To help in the study of the urban system, researchers have divided it into three categories: (a) the "macrosystem", which refers to the city/city system as a whole; (b) the subsystem, which refers to activities (e.g. water systems management) within the whole; and (c) the micro, which consists of individual choice, mostly evident at the neighbourhood level. (Palma and Krafta, 2001)

[6] The European Commission's work on "nature-based solutions" — inspired by or supported by nature — provides case studies of policies that have encouraged city planning and development in this direction. Investing in green infrastructure can also have a positive impact on the social framework of the city See the European Commission website: https://ec.europa.eu/research/environment/index.cfm?pg=nbs.

(a) Pursuing a locally focused step-by-step approach towards carbon neutrality, setting ambitious targets and actions regarding energy production, energy efficiency, waste management, and carbon sequestration;

(b) Improving options and utilization of sustainable transportation, including priority for non-motorized transport and public mass transit.

Restoring local ecosystems for economic and environmental benefits

As a response to the increased frequency and intensity of hazardous floods in the Mahanadi Delta, Odisha State, India, the State government considered the construction of a dam on the Mahanadi River and commissioned a participatory assessment of its potential effect on nearby Chilika Lake. The assessment revealed that local communities preferred to maintain water flows for their positive impact on agricultural productivity, which more than offset flood-induced damages. Fishing communities downstream also preferred to maintain flows to provide a constant stream of sediment and nutrients that support fishery productivity.

With these considerations in mind, the government decided to implement alternative means to address flood-related risks, while maintaining and regulating water flows. They re-established wetland ecosystem functions, restored degraded ecosystems, and invested in nature-based solutions. These measures proved not only to be the most effective intervention in addressing the negative impacts of the Mahanadi Delta, but also carried significant co-benefits in terms of urban resilience, ecosystem health, and human well-being.

Source: excerpt from Wetlands International, undated — see more at www.wetlands.org.

Shift urban patterns of consumption and production to become more sustainable

38. The consumption and production patterns of cities are a critical element of achieving global resilience and sustainability. Sustainable consumption and production has both environmental and social implications and much of this plays out at the local level. In 2014, humans used about 50 per cent more resources in one year than the planet is capable of regenerating (WWF 2014). This has implications for basic needs such as access to food and clean water, and ultimately to human survival. Attempts to transform our resource consumption patterns need to recognize that this is not just an environmental issue. Inequality is also an important issue that needs to be addressed, with current levels of consumption three times higher for the average European than the average Asian, and four times higher than the average African. Inhabitants of rich countries are often consuming ten times more than people in developing countries (Lorek and Fuchs, 2013).

39. To develop more sustainable consumption and production patterns, it is recommended that local and national government actors:

(a) Use appropriate technology and encourage open use of databases to gather, organize, and manage information on consumption that is critical for developing policies to shift consumption patterns;

(b) Design locally relevant interventions such as compact community models that maximize the co-benefits of economies of scale (e.g. transport-oriented

development, low-energy zones). Initiatives can also take place at the national level, such as France's food waste reduction policy that bans supermarkets from throwing away food products that can still be used;

(c) Ensure that sources of critical resources which are part of a city's basic services and daily consumption (e.g. clean water, food) are secure and protected by policy at all levels of governance. This includes for example, linking watershed management (which may cross administrative boundaries) to the city's environmental plan;

(d) Strengthen the connectivity between urban and rural areas to address production issues. This has an impact on concerns such as food waste as highlighted in issue paper 10 on urban rural linkages which notes that food loss can be reduced by access to markets, storage, and food literacy — a concern both rural and urban (p. 3).

Enhance system resilience to physical, economic and social shocks and stresses

40. Strengthened resilience of city systems enables survival, adaptation and growth in the face of disturbance. Shocks and stresses may be discrete and temporary or endure over a long period, and a more resilient city helps to protect its residents, their cohesion as a community, and their habitat by responding, adapting, and transforming in ways that restore, maintain and even improve its essential functions, structures and identity (see University of Cambridge and ICLEI 2014). Specific recommended policy actions include the following:

(a) Ensure that the city infrastructure and framework are resilient: city planners are encouraged to use creative and inclusive urban planning and design models that include flexible and adaptive use of space, which can minimize adverse impacts of shocks, such as public parks in coastal and riparian zones that also function as flood buffers. Infrastructure investments have to be accessible, reliable and adaptive, meeting long-term demand while ensuring environmental sustainability and climate resilience.[7] Policies should also ensure that houses and buildings, which are important assets of cities, are designed and built to minimize disaster risks;

(b) Invest in "soft" measures, like stronger coordination among diverse actors, development of social capital, or incentives to change norms and behaviours that can contribute to resilience building: this paper strongly recommends, for example, the appointment of a resilience officer at the level appropriate to the local context (e.g. city or metropolitan region) with the responsibility of developing and leading implementation of local strategies. Other measures include education of the general public and encouragement of community-led climate change adaptation solutions. Cities should also adopt and implement the Sendai Framework, including development of national and local disaster risk reduction strategies;

(c) Develop a thorough and detailed understanding of disaster risk in all dimensions of vulnerability, capacity, exposure of people and assets, hazard

[7] Resilient infrastructure is characterized by "redundancy" through spare capacity to accommodate disruption, such as distributed infrastructure networks and multiple sources for food, water and goods. "Adaptability" is also a key trait such as utilizing decentralized and modular approaches to enhance inclusivity and flexibility, for example the use of local renewable energy resources as backup for the main grid.

characteristics and environment: leverage this knowledge for risk assessment, for prevention and mitigation, and for development and implementation of appropriate preparedness and effective response, including early warning systems and contingency plans for critical infrastructure. This should build on hazard assessments for relevant stresses and shocks (such as drought, sea level rise, tsunami, earthquake, flooding, etc.) and test vulnerabilities, first and secondary consequences of failure (including interdependencies between risks and functions) and preparedness;

(d) Protect and create place-specific physical attributes that enhance capacity for adaptation: and that address both the need to prepare for a shock and the need to recover (Allan and Bryant 2011). For example:

(i) A network of diverse spatial types of built form and open space;

(ii) Adequate flat, safe and usable open space as a locus for communities to recover;

(iii) A built environment configured to facilitate community cohesion;

(iv) Population densities and building types that enhance the feedback loops vital for resilience-organization that enables self-sufficiency at local, neighbourhood, city and regional scales and also maximizes the potential for diverse forms of connectivity within and beyond a city.

Ecosystem-based adaptation in Lami Town, Fiji

UNEP has been working with UN-HABITAT, the Secretariat of the Pacific Regional Environment Programme (SPREP) and the local city-council to design and implement an ecosystem-based adaptation strategy for Lami Town, Fiji, to protect the local population from climate change-related threats. As part of the project, a variety of adaptation approaches — ranging from ecosystem-based adaptation options to engineering options were assessed, through least-cost and cost-benefits analysis.

The assessment clearly revealed the important services provided by mangroves, forests, seagrass, mud flats, and coral reefs to reduce flood and erosion, while contributing to development objectives, e.g. by supporting inshore artisanal fisheries. The analysis also showed that an adaptation plan focused on ecosystem-based options, with some targeted engineering options, would result in the highest benefit-to-cost returns, in terms of avoided damages and provision of secondary ecosystem services.

Source: excerpt from Rao et al. 2013.

B. Cross-cutting policy recommendations

41. Processes and context determine how well the policies outlined above can be achieved. There are four important catalysts, introduced in section II.B, that need to be included in policy development.

Interdependent governance

42. Local policies should both inform and implement regional, national and global policy. At the same time they need to embrace global issues in their local context. For example, the global influence of carbon emissions should be considered when local policies are formulated. National policies, in turn, should complement global principles and recognize the unique cultural and physical environments of local areas.

43. Cross-boundary, inter-municipal, and urban-rural cooperation are also essential. Biological and physical effects such as those caused by air and water pollution extend beyond jurisdictional and political borders, and the resilience of a city may be determined by connectivity and resource flows within the region. Appropriate systems should be used to balance interests and facilitate cooperation, such as upstream-downstream water management. Policies should encourage prosperity of all types and sizes of cities, not just the largest.

44. Policies targeting local problems should take into account any potential influence on larger or adjoining geographical areas, and global and national policies should also consider the impacts on specific localities. The importance of local participation in the formation of national and global policies, and vice versa, should be emphasized.

45. Policies should recognize interdependencies through, for example, the following measures:

(a) Account for potential synergies and multiple benefits from broader adjoining places;

(b) Develop national strategies with strong input from and responsibilities for lower levels of government. Examples include: national sustainable urbanization strategy, national resilience action plan, national mitigation and adaptation support programmes for local governments and the Smart Cities programme. Share authority and financing between municipalities or metropolitan areas and state or national government agencies for managing and enforcing land use, property rights and environmental services;

(c) Promote cooperation and coordination among actors at different levels and across borders, e.g. through regional and inter-municipal bodies. Set targets to align various policies towards common goals;

(d) Minimize any conflict between national policies and local community interests;

(e) Encourage cities to join global campaigns, networks and initiatives.

Local participation and inclusion

46. The interdependent nature of urban subsystems places an important responsibility on local governments to guide and manage local activities. Decentralizing decision-making and enabling local communities ensures that the specificities of ecology and place inform decisions on environmental matters. Local participation also forms the basis for social cohesion, provides for and protects diversity, and creates greater equity in knowledge capital within a community: all are essential attributes of building resilience in cities.

47. The transformation of our cities will only be possible through organized and committed participation by diverse actors. As argued in Habitat III issue paper 1 on inclusive cities, "the greater cultural diversity found in urban areas can deconstruct social norms, gender stereotypes, and traditions or customs that [currently] hold women and disadvantaged groups back, thereby reducing associated discrimination" (Habitat III issue paper 1, 2015, p. 2). The essential role that women must play in achieving sustainable and resilient cities, as well as their potential to contribute meaningfully in decision-making processes, needs to be acknowledged. Women and girls should be empowered not only for equity reasons, but also because their capacity to drive change is a key resource that is often underestimated. Governments and multilaterals should also listen to and consider the diverse voices of local communities, including locally elected officials, youth and elderly, persons with disabilities, ethnic minorities, and other marginalized groups, and promote and support local and indigenous practices and solutions to building resilient cities. These different actors, with their own knowledge systems, practices and experiences, each contribute to the diversity of system function as well as the local feedback mechanisms needed to strengthen resilience.

48. Private citizens, businesses and civil society organizations are potentially key drivers of change, and a source of capital and innovation and joint ownership. Urban policies, structure and function should take shape in collaboration with residents and other stakeholders with interests in sustainable, healthy and resilient cities.

Engaging with the most substantial cross-cutting set of power relations that shape the different experiences in and influence on the urban environment is critical to achieving urban environmental sustainability and resilience. This entails particular attention to women, who often have unique and direct experiences with the urban environment, and less opportunity to participate in decision-making processes. This exclusion perpetuates the notion of women, especially those from poor and low-income communities, as passive rather than active agents of development.

49. Policies should promote local participation and inclusion through the following measures:

(a) Allocate responsibility on the smallest, lowest or least centralized level that is reasonable, following the subsidiarity principle;

(b) Create local action bodies with specific tasks and responsibilities, or other opportunities for local actors to contribute and innovate;[8]

(c) Create clear incentives (including financial) for local action;

(d) Develop new and duplicate existing successful models of cooperation between the public, the business sector, and local and national government;

(e) Use mechanisms to identify and engage diverse groups in policy formulation and implementation, especially women, as well as those most vulnerable to environmental shocks and stresses;

[8] Issue paper 1 states, "An essential aspect of ensuring inclusion and meaningful participation by all is through the mobilization of excluded groups themselves whose ability to engage with more powerful stakeholders is greatly enhanced through collective action."

(f) Promote participatory budgeting at all levels;

(g) Create mechanisms to enable participatory urban planning, e.g. for civil society engagement with local government during information generation, design, implementation, and monitoring stages, including the co-production and sharing of data and knowledge about the natural and built environments.

Knowledge and capacity

50. The scientific knowledge that has been developed regarding global environmental trends, ecosystem function, and the availability of natural resources has helped humanity to better understand the natural environment. Cultural heritage and historical memory represent critical knowledge of how a community relates to the natural environment (i.e. what a community has learned from nature, how it has been using nature to thrive, and how it has dealt with moments of crisis). The social habits (i.e. common practices, relationships, and shared norms) that communities have developed need to be further explored, to acknowledge good practices and build on them. Climate change will also require new knowledge of the impacts and consequences on local areas and communities, and climate change models should be adapted and shared with local government to build relevant knowledge. Private sector entities should also contribute their knowledge, skills and resources to the policy formulation and implementation process.

51. Local institutions and grass-roots organizations play a key role to collect, compile, share, and apply knowledge. The combination of scientific knowledge, cultural heritage, and popular knowledge represent an important resource to:

(a) Optimize people's capacities and capabilities with regard to urban ecology and resilience, through development of knowledge, experience and skills;

(b) Drive behavioural change and institutional choices towards more resilient cities and a healthier urban ecology;

(c) Cultivate characteristics of resilience such as the ability to handle surprise, and to apply past learning to new contexts and challenges;

(d) Provide a foundation for better management of natural resources and of the local and global environmental commons;

(e) Create pathways to influence change through the interaction of researchers and decision makers.

52. Policies should build knowledge and maximize utility through the following measures:

(a) Promote research and data collection and analysis on urban ecosystems and resilience; utilize open source software to capture and benefit from new means of collecting data;

(b) Develop a knowledge observatory for cultural knowledge and memory;

(c) Create mechanisms to enable learning from the knowledge, data, and experience of previous stresses and shocks, including disaggregation of data by gender, age, etc.;

(d) Share statistical data between national and local governments at no cost;

(e) Integrate information about urban ecology and resilience into the educational system, from primary through continuing education;

(f) Incorporate traditional and indigenous knowledge into policy formation and implementation;

(g) Implement key concepts, knowledge and skills as orientation for people who are elected to a decision-making position;

(h) Develop planning guidelines for urban ecology, especially considering its role in resilience and disaster risk reduction.

Utilizing new knowledge to mitigate health risks

Changing climate is affecting patterns of vector-borne disease, and public health agencies need to update their community outreach accordingly. A collaborative disease surveillance study in Can Tho, Viet Nam, found that rains are now coming in seasons that were historically dry, affecting mosquito breeding patterns and therefore disease patterns. The Can Tho Project brought together local governments, NGOs and researchers to understand these changes and transform effectively this new knowledge into policies and make health systems more flexible, responsive, and resilient to these changes.

Source: excerpt from Daga 2014, see more at: www.rockefellerfoundation.org.

Design integration

53. Issues of urban environmental sustainability and resilience are increasingly complex, and it is no longer possible to address them with top-down policies or single-issue solutions. One way to acknowledge and manage this complexity is through improved urban design, where "design" is understood to be a process and a set of techniques to deal with issues in a holistic and integrated way. It also offers a medium to achieve greater outreach to small communities where action can take place. It is essentially an activity that simultaneously addresses the bottom-up complexities of everyday life and the top-down implementation of national priorities. Unlike broad planning which tends to be reductive, spatial design can address specificities and thus has more potential to influence behaviour change. Policies should encourage adoption and integration of design processes and principles:

(a) Encourage "nature-based design" based on the principles of energy conservation, reduction of toxic waste and greenhouse gases, diminishing dependence on fossil fuels, and a sensitivity for waste, pollution, and the depletion of the world's resources. This approach works towards total ecological restoration;

(b) Use design to address local environments on a site-specific basis with a thorough understanding of local conditions, natural ecologies, local culture and contextual influences and effects, and based on diagnosis of the city's risks and vulnerabilities and adaptive capacity. Utilize this approach to develop nature-based solutions based on local ecosystems;

(c) Incorporate characteristics of resilience such as modularity, flexibility, and redundancy into the design approach;

(d) Engage local communities in decision-making, framed by resilience goals such as diversity, variability, adaptability and redundancy, and by urban ecology goals such as biodiversity protection, improved water and air quality, and natural habitat connectivity;

(e) Policymakers should work with designers to maximize the value of interventions in terms of relevance and multiple benefits. For example, preventative measures for earthquakes need to be designed so they are part of daily activities, and will therefore be maintained and valued by the community.

Design for resilience and multiple benefits

A successful example of design integration comes from the General Hospital in Karlstad, Sweden, which is located in an area of high flooding risk. To cope with the risk, a levee is being planned that will protect the hospital, surrounding area, and essential roads. The levee will also function as an elevated pedestrian and bicycle path, with a green storm-water management system and surface shutters to let extreme rainfall pass through. This approach creates additional benefits from flooding protection measures by encouraging bicycle use, in line with the municipality's climate and environmental strategy

Source: excerpt from Karlstad Municipality, undated — see more at www.karlstad.se/.

C. Criteria for identifying policy priorities

Criteria for the establishment of priority policies	*Demonstration of criteria*
1. Urgency	Policies should be designed to target the most urgent issues in terms of risk (highest likelihood of occurrence and most severe impact)
2. Impact	The success of any strategy will be determined by its uptake within the community and the potential for behaviour change. To achieve this, all policies should demonstrate not only technical merit, but also their potential to effect change, and should be accompanied by implementation and communication policies
3. Equity	Policies should demonstrate that they can have an effect for all socioeconomic groups especially the most vulnerable
4. Feasibility	Policies should be developed on the basis that they are implementable within strict time frames and available resources
5. Diversity	Policies should demonstrate that they accommodate all cultures, and do not disadvantage any culture
6. Multiple benefits	Policies should demonstrate multiple benefits: e.g. they will have positive impacts across various sectors for sustainability, social equity, and/or environmental health, while addressing vulnerabilities

Criteria for the establishment of priority policies	*Demonstration of criteria*
7. Transformability	All policies and strategies should demonstrate the potential for transformation of communities, not just change of physical environment
8. Replicability	Policies should be implemented on the basis that they can be repeated, with lessons learned also used for future initiatives

IV. Key actors for actions: enabling institutions

54. The actors and enabling institutions needed to achieve sustainability and resilience will be highly specific to the local context but typically include public institutions, civil society organizations and associations, businesses and business networks, and formal and informal networks of residents. This section provides guidance to governments at all levels on how to identify key actors for implementation. Governments should:

(a) Acknowledge the essential role that women and girls have and should have, and identify and address the barriers that exist to their adequate participation at all levels of decision-making;

(b) Consider the existing and potential sources of diverse knowledge (academic, traditional/indigenous knowledge, market-based practical knowledge). Actively include groups with unique perspectives, such as indigenous groups with knowledge systems of society and landscape that help to interpret social cohesion and environmental sustainability;

(c) Enable an enhanced role for the private sector in decision-making and investment, and ensure responsibility for actions. The private sector should be enticed and empowered to be active leaders of positive change;

(d) Identify key contact points for mobilization and communication related to transformation;

(e) Identify the most vulnerable populations. Cities cannot be sustainable when significant portions of the population lack access to basic services and key resources, and are not able to participate in city decision-making;

(f) Understand the use of space and the capacity for its adaptation by people; review spatial relationships and utilization of space by urban residents and organisms; explore the long-term implications of infrastructure decisions for specific groups and communities to understand which actors need to be involved.

V. Policy design, implementation and monitoring

55. This section proposes an overarching implementation framework that policymakers can use as a model of action to support the overall effort towards greater resilience and healthier urban ecology. As presented here, the implementation framework provides guidance for more effective and long-lasting policy interventions, and connects the policy priorities outlined above to the broader context of the urban policy process. The implementation framework has three key

pillars: institutional context, financial mechanisms, and monitoring systems. The three pillars are complementary and closely linked, enabling the paradigm shift that is needed to change the way our cities are built and governed.

A. Establish an enabling institutional context

56. Governments have the responsibility and the legal capacity to establish and strengthen the framework within which different actors operate and interact. The constitutional and regulatory environment they create and enforce is a fundamental condition to enable all stakeholders to play their roles.

Mainstream ecology and resilience concerns into all policies and regulations

57. A key principle of the enabling framework is to incorporate ecology and resilience concerns into all policies and regulations linked to urban development. Ecology and resilience should be anchored into the existing national and local legal frameworks, and cut across all sectors of the urban agenda, ensuring coherence within the policy framework.

Mainstreaming ecology in the institutional setting: merging economics and environment municipal departments

The government of Hannover, Germany, took the step of combining its Department of Environment and Department of Economic Affairs in 2005, which implied a major shift into how local economic development and environmental affairs are managed: not as separated matters but as part of the same agenda. Among other things, merge resulted into greater integration of ecological priorities into economic decisions such as land purchase and allocation. The new department also oversees public relations, to help ensure that public awareness efforts are aligned with the city's ambitious environmental targets.

Source: excerpt from ICLEI and GIZ 2014 — see more at www.iclei.org/urbannexus.

Ensure cross-cutting approaches and exploit all possibilities for multisectoral integration

58. Scarce resources have to be protected, and their use regulated and optimized. To achieve this, we need to strengthen crucial linkages that exist between sectors such as water, energy, and food. Less apparent but equally important are links to mobility, housing and employment, or waste management and energy production. These too must be recognized and considered in policymaking. All policies and initiatives associated with urban development should be designed to maximize opportunities for synergy and cross-fertilization, avoid contradiction among policies, and enhance horizontal cooperation among sectorial bodies and institutions.

Curitiba, Brazil: the "ecological capital" forerunner in Urban NEXUS planning

Curitiba, the "ecological capital" of Brazil, is a world-renowned model for innovative integrated planning and management. Through the institutionalization of an independent public authority (the Institute for Urban Planning Research — IPPUC), the city designs, coordinates and implements cross-cutting solutions to address multiple urban challenges for housing, transport, water and waste management.

Source: excerpt from Cauchois et al. 2014 — see more at www.iclei.org/urbannexus.

Allocate responsibilities to appropriate institutions at all levels

59. Following the subsidiarity principle, each responsibility and associated resources should be allocated on the lowest reasonable level. To ensure implementation, overarching responsibilities should be allocated to the national level (examples include: dedicated ministries, national agencies, national research bodies). Strengthened subnational governments will be key partners to national Governments for implementing sustainable, resilient cities. Strengthening of the subnational level includes: formal and legal responsibilities, the right to generate income (taxes, fees, etc.), human capacity and knowledge. Similarly, at the regional and global scale, the role of city networks to promote exchanges of experience and mutual support among cities and to support joint target setting and action, especially in the fields of ecology and resilience, should be recognized and encouraged.

Creating and empowering inter-municipal cooperation bodies

60. Municipalities of different sizes and characteristics are often interconnected and functionally integrated because of urbanization trends, commuting flows, and ecosystem linkages (e.g. water basins). These connections are dynamic in nature and are rarely reflected by municipal boundaries. In this context, cooperation among government institutions within functionally integrated urban areas needs to be strengthened through innovative institutional arrangements. These include the establishment of new bodies with or without their own governance structures, such as metropolitan areas, regional planning bodies, inter-municipal waste management and transportation boards, etc. Similarly, improving the institutional linkages between urban and rural areas can accelerate the transformation towards ecologically healthy and resilient cities.

Appointment of a Chief Resilience Officer

One critical step cities can take to facilitate their resilience building is to appoint a Chief Resilience Officer (CRO). The CRO is an innovative position in city government that acts as the point person for resilience building, ideally reporting directly to the city's chief executive and helping to coordinate all of the city's resilience efforts. The task of a CRO is to establish a compelling resilience vision for the city, working across departments and with the local community to maximize innovation and minimize the impact of unforeseen events. Examples of cities that have hired a CRO include Bristol, United Kingdom of Great Britain and Northern Ireland; Byblos, Lebanon; Medellin, Colombia; San Francisco, United States of America; Semarang, Indonesia; and Surat, India.

Source: excerpt from Berkowitz 2015, see more at www.100resilientcities.org.

B. Funding and financing urban ecology and resilience

61. One key strategy for financing is to explicitly include funding for urban ecology and resilience measures in the investment and maintenance budgets of urban areas. National and subnational budgets should also be structured accordingly, and the cost of capital should be reduced to create incentives for the private sector and households to participate in urban resilience programmes. The rationale behind creating this type of fiscal incentive is to increase the demand for urban ecology and resilience-related goods and services, expanding their economies of scale, and hence reducing the cost of goods sold. With the increase in demand and consumption, the government will gain tax revenue or at least maintain a balanced or deficit-neutral budget. Governments can also alter incentives to encourage investments in resilience, for example by regulating insurance markets to ensure that post-disaster recovery and reconstruction aid does not discourage purchase of insurance and resilience-building efforts. Post-disaster recovery funds could be partially redirected to building resilience. In addition, local and national budgets may allocate specific funds for disaster risk management.

Innovative mechanisms to increase savings

Finland's Carbon-Neutral Municipalities (HINKU) network is an example of a case where local government managed to reduce expenditures by jointly procuring solar panels. The HINKU consortium, joined by 30 municipalities and cities, launched a call for offers in 2016. The tender process will require a leasing mechanism so that municipalities will not have to make significant upfront investments and operating costs will not increase.

Source: excerpt from HINKU Forum, undated, see more at http://www.hinku-foorumi.fi.

62. Other financing strategies involve different forms of cooperation between national and local government institutions and other actors, such as the private sector, international donors and local communities.

63. Government institutions should promote models of cooperation with the private sector (e.g. new forms of public-private partnerships) to carry out specific urban ecology and resilience agendas. There are diverse possibilities, from availability payments for provision of a public facility to a direct user charge scheme for accessing public infrastructure. Regulatory frameworks for public-private cooperation are already available in many countries, and should be adapted to include ecology and resilience into the bid criteria.

64. International development financing (either grant or loan) for project-specific funding is a complex undertaking and requires a certain capability for receiving national and subnational governments to manage the scheme. A global fund for urban ecology and resilience projects for developing countries could support the implementation of projects or pilot activities for governments, private sector, or community groups, and could help to generate knowledge that would support wider implementation. Transferability and replicability of the projects would be typical criteria for such scheme to gain funding, as would the need to demonstrate financial sustainability of the products/services. Many existing funds do not have adequate modalities to support activities undertaken by subnational governments or non-State actors, but effectively addressing urban ecology and resilience will require mechanisms to support these stakeholders.

65. Initiatives from the local community should be recognized as an important source of funding for urban ecology and resilience initiatives. Community-funded projects should be promoted not only because they create ownership of the projects and assets, but also for the benefit to social cohesiveness, which itself is an important element of urban resilience. There are good practices and well-documented community-funded projects around the world, from traditional collective financing mechanisms to more recent crowdfunding schemes using Internet-based payments. Examples of specific financing mechanisms are provided in annex II.

C. Effective monitoring systems and ambitious targets

Identify and adopt effective measures to monitor performance and track progress

66. Progress towards improved urban ecology and resilience requires a careful analysis of the systems and processes that lead to positive change and that increase the ability to manage shocks and stresses, as well as the measurement of outputs.

67. Monitoring of systems and processes needs to be undertaken in an iterative and reflective manner, paying adequate attention to the quality of policy design and the efficacy of policy implementation. Specific measurable indicators of outputs can be used to track progress towards the ultimate goals of ecological health and resilience. These can include indicators on resource use, consumption, air and water quality, and measures of green space. More specific examples include ecological and water footprints, food supply and wastage, modal share, solid waste generation and disposal. Additional indicators should be used to track social aspects such as community cohesion, which are also fundamental to resilience.

68. In the development of monitoring systems, attention must be given to power relations to ensure that the data being monitored are representative of all — especially marginalized and vulnerable groups. In the case of women for example,

most data are still not disaggregated by gender, which is vital for reflecting the diversity of conditions and impacts.

69. In terms of overall principles, it is important for the monitoring of urban ecology and resilience to be driven by a local perspective and for this reason, this paper does not prescribe a framework of measurement. There is little value — particularly for resource-constrained municipal authorities — in collecting empirical data on issues that are not contextually relevant. Where these issues have significant impacts on local populations, the monitoring and evaluation process ought to also incorporate a significant participatory element in design, data collection and analysis.

70. Monitoring systems should be based on common indicators, to the extent possible, in order to ensure effective use of reporting and reduce the burden on cities. Common indicators between the New Urban Agenda and the Sustainable Development Goals, the Paris agreement on climate change, and the Sendai Framework should be used to the extent possible.

Existing monitoring frameworks

71. An initial stage of the monitoring process is the creation of baselines, although this may be challenging for many cities that do not have significant empirical records on environmental or social aspects. Several of the frameworks referred to in the table below explicitly address these issues, by focusing both on the assessment of systems and on identifying particular quantitative indicators.

Monitoring frameworks for urban ecology and resilience (in alphabetical order)

Monitoring framework	*Key elements covered*	*Source/comments*
carbonn Climate Registry (cCR)	The **carbonn® Climate Registry (cCR)** is the world's leading reporting platform to enhance transparer.cy, accountability and credibility of climate action of local and subnational governments. It is designated to support various programmes, among these the Compact of Mayors launched at the Climate Summit 2014. cCR documents commitments, actions and achievements of local and subnational governments. So far, 8 per cent of the world population is represented on this platform	http://carbonn.org/
City Resilience Framework — Arup	Assesses resilience according to four overarching themes: leadership and strategy; health and well-being; economy and society; urban systems and services. Each of these is composed of a range of sub-themes and a further set of specific indicators	Open access: www.arup.com/cri
EEA SOER indicators	Initiative by the European Environment Agency (EEA), which brings together actors from policy, research and stakeholder organizations to coordinate, integrate and harmonize the numerous approaches for urban monitoring on a European level	http://bit.ly/1pk9w1O
European Green Capital Award	The European Commission identifies the city that shows the most impressive progress in environmental performance across Europe every year, based on a set of indicators and criteria	http://bit.ly/K1cROb
European Green City Index	Compares and ranks European cities according to their sustainability performance and can therefore give insights on how to measure such performance	http://www.siemens.com/entry/cc/en/greencityindex.htm
Findicator	Up-to-date information on key social indicators of Finland, including sustainable development indicators. Includes urbanization, generation of waste and consumption of natural resources. Each indicator provides information in the form of statistical pictures, tables and analyses	http://findikaattori.fi/en
GI-REC/International Resource Panel	The Global Initiative for Resource Efficient Cities (GI-REC) is a platform for collaboration of international organizations, research institutions, city networks, and pilot cities committed to demonstrating that urban metabolism and a systems approach to city management can be operationalized. The Initiative encourages stakeholders to reimagine the lifestyles, processes, and physical structures of cities, to promote more sustainable use of current resources. It also provides avenues for cities to contribute to global environmental goals. GI-REC is currently piloting a toolkit/approach to measure resource efficiency at city level	Unpublished draft available here

Monitoring framework	*Key elements covered*	*Source/comments*
Global Protocol for Community-Scale Greenhouse Gas Emission Inventories	The Greenhouse Gas Protocol provides a robust framework for accounting and reporting citywide greenhouse gas emissions.	http://www.ghgprotocol.org/city-accounting
ICLEI — Local Governments for Sustainability	No direct indicators as such, but projects on indicators have been taking place	http://www.iclei-europe.org/
Local Government Self-Assessment Tool for Disaster Resilience	LGSAT provides key questions and measurements against the Ten Essentials for Making Cities Resilient and builds on the Hyogo Framework for Action. Using the LGSAT helps cities and local actors to set baselines, identify gaps and have comparable data to measure progress over time	http://www.unisdr.org/campaign/resilientcities/home/toolkitblkitem/?id=3
OECD Metropolitan Database/Green Growth Indicators	The OECD Metropolitan Database provides a set of five variables (population, geographic environment, labour market, GDP, patents) and around 20 indicators on the 281 OECD metropolitan areas. The Green Growth Indicators have been selected under four main headings: environmental and resource productivity; the natural asset base; the environmental dimension of quality of life; and economic opportunities and policy responses	http://www.oecd.org/greengrowth/greengrowthindicators and http://measuringurban.oecd.org
Reference Framework for Sustainable Cities	Online toolkit for European local authorities working towards an integrated management approach. Provides guiding questions for assessing projects and policies, and a broad collection of indicators in order for cities to compile their individual set	http://www.rfsc-community.eu/about-rfsc/
Resource Wisdom Indicators for Cities	Indicators include consumption-based greenhouse gas emissions, material losses, ecological footprint, residents' perception of quality of life, etc.	http://bit.ly/21D2JhD
Sustainable development of communities — indicators for city services and quality of life (IS037120)	A set of quantitative indicators covering economy, education, energy, environment, finance, fire and emergency response, governance, health, recreation, safety, shelter, solid waste, telecommunication and innovation, transportation, urban planning, wastewater, water and sanitation	Published by International Standards Organization

Sustainable Development Goals

72. The Habitat III Conference is one of the first global conferences after the adoption of the 2030 Agenda for Sustainable Development. The 17 Sustainable Development Goals agreed upon by world countries will shape the discussion on the New Urban Agenda, which will be instrumental to contribute to the achievement of the Goals at the urban and global levels.

73. The Sustainable Development Goals provide an important opportunity for aligning targets for sustainable and resilient cities (see table below). The universality of the targets associated with the Goals means that they will cover the needs and priorities of a wide range of contexts, and will also enable comparison between places and over time.

74. In addition, the stated aim of "leave no one behind" helps to ensure that sustainable and resilient cities also incorporate an explicit focus on disadvantaged and marginalized groups. Activities that take place in cities will be vital for the achievement of several Sustainable Development Goals (not only Goal 11 with its explicit focus on urban areas, but also Goal 13 on climate change). Similarly, cities will need to engage directly with several of the goals if they are to become sustainable and healthy, low carbon, and resilient.

75. The table below is not meant to represent an exhaustive list but rather illustrates the significance of the Sustainable Development Goals to urban environmental sustainability and resilience. Other Goals are also relevant.

Science-based monitoring and performance tracking in Japan

In 2007, as part of its effort toward sustainability, the Japanese Government committed to becoming a "Sound Material Cycle Society" (SMC). This decision both consolidated a long period of sectoral policy development, and set the stage for integrated planning in the future. The implementation of SMC required a renewed commitment to the 3R principles (reduce, reuse recycle), as a well as science-based methodologies for monitoring and performance tracking purposes. As a result, the material flow accounts (MFA) have become an integral feature of Japanese environmental policy, identifying the whole system of material flows in the national economy and providing itemized overviews for such flows.

Source: excerpt from Fischer-Kowalski et al. 2011 — see more: http://www.unep.org/resourcepanel/decoupling/.

Indicative elements from the Sustainable Development Goals for urban ecology and resilience

Goal	*Target*
Goal 11: Make cities inclusive, safe, resilient and sustainable	**Target 11.2** By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons
	Target 11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries
	Target 11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage
	Target 11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations
	Target 11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities
	Target 11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels.
	Target 11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials

Goal	*Target*
Goal 3: Ensure healthy lives and promote well-being for all	**Target 3.6** By 2020, halve the number of global deaths and injuries from road traffic accidents
	Target 3.9 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being
Goal 6: Ensure availability and sustainable management of water and sanitation for all.	**Target 6.3** By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
	Target 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all	**Target 7.1** By 2030, ensure universal access to affordable, reliable and modern energy services
	Target 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix
Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation	**Target 9.1** Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
	Target 9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
	Target 9.6 Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States
Goal 12: Ensure sustainable consumption and production patterns	**Target 12.2** By 2030, achieve the sustainable management and efficient use of natural resources
	Target 12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
Goal 13: Take urgent action to combat climate change and its impacts	**Target 13.3** Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

Formulating ambitious targets at all levels of government

76. While the adoption of monitoring systems is essential to monitor performance and track progress, this should be coupled with the identification of and commitment to ambitious targets by government bodies at all levels. To ensure effective implementation, these targets should be aligned at the local, national and global level and should be backed by broad consensus. Sample targets include: 100 per cent renewable energy, zero greenhouse gas emissions, zero waste, etc. Ambitious targets can set the direction of current and future action, and are useful to show governmental commitment and to send a clear message to the market. Use of platforms such as the Durban Adaptation Charter is an effective way for local governments to publish their commitments and track progress. Setting ambitious public targets is also instrumental in raising the profile of urban ecology and resilience issues, increasing awareness and contributing to long-term behavioural change.

Integrating ambitious targets in city planning

In its Environment Programme and Environment Strategy of 2009, the city of Malmö, Sweden, set an ambitious target to become climate neutral by 2020, and to run all municipal operations on 100 per cent renewable energy by 2030. This target is regularly reviewed and presented in an annual report, to be commented on by various experts. This allows the local government to monitor developments, identify problem areas and make recommendations on the way forward. All relevant information is published on a website, allowing the municipality to communicate progress, indicate areas for improvements, and increase political accountability.

Source: excerpt from Simpson R. and da Schio N. (eds.) 2013, see more at www.irena.org and www.iclei.org/casestudies.

VI. Conclusion

77. Considering the breadth of knowledge on urban ecology, environmental sustainability, and resilience, it is beyond the scope of this paper to incorporate all aspects of these concepts. Instead, we highlight below key messages that emerged during the experts' discussion and stakeholder review process. The interpretation of these key messages must take into consideration different contexts and local conditions. While principles are shared, there is no one solution to achieving urban environmental sustainability and resilience for all cities.

78. **Urban environmental sustainability and resilience should feature prominently in the New Urban Agenda.** Over the next 20 years, humans will face environmental and resource challenges that are unprecedented in scale and urgency. Addressing urban ecology through proactive investment in environmental sustainability and building resilient systems will be essential to human health and well-being. A significant majority of stakeholder comments on all Policy Unit papers were directed towards PU8, indicating an overriding interest and concern that environmental and resilience issues be included as an essential component of the final outcome document, the New Urban Agenda.

79. **Cities, when built and governed well, can be catalysts of environmental sustainability.** The common perception, especially among those who are not city practitioners, is that cities have a negative impact on environmental resources. Cities, however, also present significant positive opportunities. This paper argues that effective governance, policy, and design processes will enable local governments to contribute positively to urban environmental sustainability and resilience, with impacts far beyond municipal boundaries. Interdependencies between local, regional, and global levels are essential to ensure links between policies, actions, and impacts at various levels.

80. **Effective and inclusive governance of resources and ecosystems is critical to resilience.** Much of the current conversation on resilience is focused on disaster risk reduction and climate change adaptation. These are, without doubt, pressing challenges, but a broader perspective on the governance of key resources through effective and efficient use of resources is essential to inform long-term planning. In this context, resilience needs to also be viewed from the lens of climate change mitigation. This is critical especially for discussions on issues relevant to resources that cities manage — such as food security, access to clean drinking water, air quality, extraction of materials, transport of people and goods, selection of energy sources, and management of waste. The role of the local in this debate is essential, as is the role of all groups such as women, the elderly, the poor and indigenous peoples.

81. **Human health and natural systems are intertwined.** The Expert Group recommends that healthy people and healthy cities should be a major concern in the New Urban Agenda. Issues such as food security, air quality, and access to clean water are only a few of the many issues, which link human health to urban environmental sustainability and resilience.

82. **Built environment investments have to be made with environmental sustainability and resilience in mind.** Buildings, roads, water infrastructure, and other city investments last for decades but budgets are often approved based on short-term political and financial objectives. This paper suggests that investments should focus on the long term, and valuation of multiple benefits over longer time periods often show that the overall cost of more environmentally sustainable options is equivalent or lower. Small investments in design and planning can have a tremendous impact on material selection and use with significant long-term impacts.

83. **Nature-based infrastructure is key for reducing vulnerability and increasing the adaptive capacity of cities.** Physical infrastructure such as roads and utility services need to be accompanied by nature-based infrastructure as an essential component of adaptive capacity.

84. **Effective use of soft systems and design are important processes for building resilience.** Institutions, knowledge and social cohesion are vital to enabling adaptation, response and recovery. Resilience is inextricably linked to the complex and interdependent characteristics of urban systems, with their diverse inhabitants. Progress towards improved urban ecology and resilience requires a careful analysis of the systems and processes that lead to positive change. This includes a broad understanding of stakeholder groups, adoption of measures to monitor performance and track progress, and ensuring that decisions are based on baselines and indicators that are continuously updated. One of the important

processes is place-based design, which can find ways to integrate the particularities of a place and a culture with broader objectives for sustainability and resilience.

85. We conclude by noting that this paper is inevitably limited in breadth and depth. Throughout the discussion and review process, the experts reflected on a wide range of resource-specific and place-specific issues that have been alluded to but not fully addressed in this paper. Resources such as water, energy, and waste — as well the interrelationships of these three — are critical to urban environmental sustainability and resilience. The management of landscape and buildings for food and water security, social cohesion and cultural identity are also key topics that need to be further addressed on a detailed scale. We hope that these key topics will be included and figure prominently in the New Urban Agenda.

Annex I

Glossary

Systems thinking	Replaces linear and positivist directions in urban planning and reinforces the primacy of the relationship between elements and the flow of materials and energy rather than individual elements. The natural, physical, human, cultural, and social environments are linked in systems thinking. It recognizes interdependencies and interconnections between policies and actions, achieving multiple benefits in outcomes that address multiple issues.
Urban ecology	Urban ecology is the systems-based understanding of biotic and physical elements that occur in urban areas. It recognizes the interaction between natural systems and social and cultural systems, among others. Urban ecology places particular importance on the primacy of natural systems in contributing to livelihoods, well-being and resilience, and focuses on the interdependence of key resources (usually water, waste, and energy) and their impact on city development. In Policy Unit 8, the term sustainable urban development refers to the normative outcome of policies and actions related to the urban ecology, where "sustainable" is defined as the state wherein natural systems function, remain diverse and enable the ecosystem to remain in balance.
Resilience	Resilience is a complex and dynamic system-based concept used differently in a variety of disciplines, and also a simple concept referring to the ability of a system to return to a previous or improved set of dynamics following a shock. It also refers to the potential for individuals, communities, and ecosystems to prevent, absorb, accommodate and recover from a range of shocks and stresses. At the urban scale, resilience requires investment in both man-made and nature-based "hard" infrastructures, as well as "soft" systems such as knowledge and institutions. The concept of resilience when applied effectively can provide a useful base for more substantial changes in the underlying social, political and economic drivers of risk and vulnerability. Factors that influence resilience of cities include their organizational structures, functions, physical entities, and spatial scales. A resilient system can continually survive, adapt and grow in the face of resource challenges and disturbances in an integrated and holistic manner for the well-being of the individual and collective. Those challenges and disturbances may be discrete and temporary, such as a natural disaster, or endure over a longer period, such as a shift in climate conditions or change in availability of key resources.

Annex II

Financial instruments for urban ecology and resilience

(In alphabetical order — compiled by Sarah Colenbrander, IIED)

Instrument/mechanism	*Definition*	*Contribution to ecology and/or resilience*	*Examples of cities where implemented*
Carbon credits	A carbon credit is a financial instrument that represents one ton of carbon dioxide equivalent being removed from the atmosphere through sequestration or not being emitted through choice of a low-emission technology. A carbon credit can be sold by the actor who has avoided one unit of CO_2 emissions to another actor, who can offset the reduction against their own carbon footprint	The resources from carbon credits can be used to finance mitigation projects that enhance resilience, such as waste-to-energy infrastructure that both reduces the size of landfills and generates energy that can support development	Chandigarh (India), Hefei (China)
Community Resilience Fund	The Community Resilience Fund (CRF) is a global mechanism for channelling resources to diverse communities in order to operationalize resilience practices and reduce their vulnerability to hazards and calamities. CRF has helped mobilize grass-roots women's organizations living in disaster-prone and high-risk conditions. The Fund operates based on a "Resilience Diamond," a holistic bottom-up strategy connecting four interlinked elements with strategic objectives of strengthening grass-roots women's groups organizing and leadership, and deepening grass-roots women's understanding of the risks that may threaten their communities in order to mobilize them to address these risks through community-led action	For many years, grass-roots women have been viewed as a vulnerable group in the face of disasters. They have been seen as victims rather than actors who can mend and improve their communities. As grass-roots women-led practices spread globally, the need for CRF grows proportionally with its goal of empowering women to emerge as leaders and champions of resilience. CRF is an increasingly important financing scheme for strengthening grass-roots women's capabilities and work	CRF is spearheaded by Huairou Commission and Groots International. CRF operates in 21 countries in Asia (Bangladesh, India, Indonesia, Nepal, Philippines, and Viet Nam), Africa (Ghana, Kenya, Madagascar, United Republic of Tanzania, Uganda, Zambia, Zimbabwe) and Latin America and the Caribbean (Brazil, Ecuador, Guatemala, Honduras, Jamaica, Nicaragua, Peru, Venezuela (Bolivarian Republic of))

Instrument/mechanism	*Definition*	*Contribution to ecology and/or resilience*	*Examples of cities where implemented*
Contingent credit facilities	Contingent credit facilities allow a government body to 'draw down' funds in the immediate aftermath of a natural disaster, such as an earthquake or cyclone. To date, this facility has usually been attached to a larger loan through a multilateral development bank, and the government can access this line of credit only in the event of an emergency	Contingent credit reduces the scale of reserves that a government needs to have available, while ensuring that has enough liquidity to launch an emergency response and begin recovery in the event of a shock. In other words, contingent credit provides a government with the finances to immediately respond to events rather than have to negotiate terms with prospective lenders	Fiji, Peru, Seychelles
Green taxes/ environment-related taxes	Environment-related taxes are defined as any compulsory, unrequited payment to general government levied on tax bases deemed to be of particular environmental relevance	The main rationale of imposing a tax on an environmentally harmful substance or activity is to impose a financial cost to be paid by the polluter, and to use the revenues of green taxes to restore and enhance ecosystem services. This helps to internalize the full costs of economic activities and inform behavioural and business choices accordingly	Delhi (India), London (United Kingdom of Great Britain and Northern Ireland)
Insurance	Insurance is an arrangement whereby an institution agrees to provide compensation for a specified event, such as a hurricane or tsunami, in return for regular payments. This permits cities or other actors to transfer much of their risk to insurers and reinsurers	While households, local governments, businesses and other actors will still bear much of the impact of shocks, insurance transfers many of the financial costs of these shocks to another party. By paying for rebuilding, health care and other costs after an event, insurance can facilitate recovery	Insurance is typically taken out by individual actors (households, businesses, etc.) through commercial insurers, but city governments can support this through information and enabling financing mechanisms
Municipal green bonds	A municipal bond is a security or debt obligation issued by a local (usually city) government. The investor effectively lends money to the local government, in return for which they are paid a specified amount of interest until the bond's maturity date, when the	A municipal bond raises the finance for local governments to invest in infrastructure. The green label requires that this infrastructure has a positive impact on the environment, i.e. the resources cannot be used for business as usual infrastructure. Green municipal	Gothenburg (Sweden), Johannesburg (South Africa), Spokane (United States of America)

Instrument/mechanism	*Definition*	*Contribution to ecology and/or resilience*	*Examples of cities where implemented*
	principal is repaid to the investor. For a 'green' municipal bond, the loan must be used to finance environmentally friendly infrastructure	bonds have been used for bioenergy, solar and wind power, improving the energy efficiency of buildings and low-carbon public transport systems (e.g. hybrid buses)	
"Pay as you save" and "pay as you go" schemes	"Pay as you save" and "pay as you go" schemes aim to spread the costs of infrastructure over a substantial period of time. A body with large financial resources provides the capital investment, and is repaid in small instalments by the user/owner	"Pay as you save" and 'pay as you go' schemes help to finance the high upfront costs of new infrastructure that can enhance resilience. For example, it can fund retrofitting to improve building efficiency so that households are less vulnerable to extreme temperatures and energy price shocks, or it can fund new infrastructure to improve households' access to energy and water	"Pay as you save" is widely used in the United Kingdom to cover the costs of refurbishing houses to improve their energy efficiency. "Pay as you go" is widely used in sub-Saharan Africa to cover the costs of solar home systems
Payment for Ecosystem Services (PES)	PES are incentives offered to landowners in exchange for managing their land to maintain or enhance specific ecosystem services	PES can be used to improve financial returns for landowners with incentives to conserve particular ecosystem functions, e.g. rainwater infiltration to reduce flooding	Examples of developing countries that have adopted PES include Brazil, Costa Rica, Uganda and Viet Nam
Transferable development rights (TDR)	TDR is a land zoning or planning tool used to manage spatial development by redirecting new developments to sites that are less socially, culturally or environmentally sensitive. Essentially, the right to develop one particular area (the "sending area") is transferred to another area (the "receiving area"). The person or institution that owns the sending area is compensated for the loss of those development rights with a share of revenue generated from development in the receiving area	TDR provides a way to protect ecosystems that contribute to resilience, such as wetlands that absorb excess run-off during heavy rains and therefore reduce flooding. TDR has also been used in Mumbai to protect informal settlements from being relocated and to generate revenue for upgrading	Hong Kong (China), Mumbai (India), New York (United States)

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Policy paper 9: Urban services and technology*

Note by the secretariat

The secretariat of the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) hereby transmits a policy paper entitled "Urban services and technology", prepared by the members of Policy Unit 9.

Habitat III policy units are co-led by two international organizations and composed of a maximum of 20 experts each, bringing together individual experts from a variety of fields, including academia, government, civil society and other regional and international bodies.

The composition of Policy Unit 9 and its policy paper framework can be consulted at www.habitat3.org.

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Policy paper 9: Urban services and technology

Executive summary

Urban services and mobility are key to inclusive, safe, resilient and sustainable cities and human settlements

The New Urban Agenda needs to make concrete recommendations for cities and human settlements to become inclusive, safe, resilient, and sustainable by including access for all to adequate, safe, affordable, accessible and sustainable basic services and infrastructure. This requires particular attention to the most vulnerable groups in society, such as the urban poor, women, children, older people and those with disabilities. Urban services like water, energy, waste treatment and transport are vital enablers for social and economic development opportunities and are thus key to achieving the 2030 Agenda for Sustainable Development and the Sustainable Development Goals. Hence, access to these services ought to be a basic human right.

Over the coming decades, services and infrastructure for transport, water, sanitation, waste management and energy have to be provided for a rapidly growing urban population. Global urban growth poses enormous challenges, in particular with regard to greenhouse gas emissions, social exclusion, safety and air quality. This requires a transition towards more sustainable, safe and inclusive provision of urban services. Providing access to urban amenities, transport has a key role to play in this. Furthermore, with greater vulnerability to various types of risks, there is more need to improve the resilience of all service-providing infrastructures. Finally, equal access to basic services for all groups and communities should be available, with the emphasis on affordability and safe environments where basic services can be enjoyed for all, especially for the most vulnerable and those dependent on these services for living a decent life. Services and access to amenities are not merely the provision of infrastructure but also boosting efficiency, embracing local innovation and grass-roots initiatives.

Technology solutions must be fit for purpose to contribute to equality and access to urban services for all, including vulnerable groups. The advancement of smart city concepts and the high pace of information and communications technology (ICT) becoming nested within the urban sphere both call for further yet careful integration into infrastructure and service polices under the conditions of inclusiveness, safety, resilience and sustainability, while taking into account the distinctive governance and innovation dynamics of urban services and infrastructure. Resilience may be improved by developing adaptive systems and networks, including decentralized ones facilitating the self-sufficiency of municipalities and communities.

Towards new modes of governance: time for concerted action

A human-centred, inclusive and multilevel governance approach, integrated urban development, applying the principle of subsidiarity and appropriate legislative frameworks and enforcement mechanisms are critical to the delivery of urban services and ensure coordinated action. To support this, intra- and intercity learning and capacity-building can help to leapfrog to sustainable solutions.

International efforts to implement the New Urban Agenda need to focus on all levels of governance and decision-making to ensure that multilateral and bilateral organizations, local authorities as well as national Governments conform to and adopt the New Urban Agenda. Thus the New Urban Agenda should respond to the following key messages.

Key messages on urban services and technologies

Access for all

Cities have the responsibility to provide adequate, sustainable and resilient urban infrastructure and services to all. These refer to both high-quality living conditions — through services such as safe water supply, waste management and electricity — and to facilitating convenient and equal, non-discriminatory access to urban opportunities like jobs, education, health care and public spaces through transport systems and mobility services. To supply these services, local authorities need funding stability and predictability as well as appropriate policy and planning capabilities. This requires support by national Governments and the international community.

Efficient use

Efficient and effective use of urban services require local and national policies that support people to reduce the consumption of finite resources and shift demand towards sustainable options, including reducing water, waste, energy use, and demand for private motorized travel. Local and national governments should prioritize dense urban development and employ the most appropriate policy and technology options to support sustainable choices for services, consumption and mobility.

Local leadership

Local authorities should take responsibility and leadership for inclusive well-being and the sustainability of cities. To do so effectively, they need to engage and develop alliances with the relevant stakeholders at the local, national, and international levels.

National policies and funding support

National Governments need to enable local authorities to provide adequate services to urban population. This includes frameworks for the funding of the development and operation of services and the ability for local authorities to associate and coordinate beyond city boundaries.

Introduction

1. Urban services like water, electricity and heat, waste treatment and transport are vital enablers for social and economic development and thus key to achieving the Sustainable Development Goals. Access to these services should be regarded as a basic human right.

2. This paper outlines findings of Policy Unit 9 on urban services and technologies based on the contribution of an international team and comments from

governments and international and civil society organizations. It focuses on the main policy challenges, criteria for priorities and actions for implementation to be included in the New Urban Agenda. It explores the key actors for implementation and elaborates on the policy design, implementation and monitoring of urban services and technologies in the New Urban Agenda.

3. The New Urban Agenda builds on the Habitat Agenda, which included the human right to adequate housing and water, and the corresponding obligations of States and Governments. Transport plays a key role in the urban context as it provides access to jobs, goods, social and cultural exchanges, health services and education. Planning and operation of urban services and transport should ensure an adequate level of mobility to ensure the functioning of cities for all inhabitants. Implementation strategies for urban services need to consider different regional and socioeconomic conditions, local administration and management, regulatory frameworks and applicability of technological solutions. Accessibility is crucial for the vulnerable population as it is a key factor for providing equal opportunities in the urban environment.

4. Urban services are major ingredients for the provision of chances for a self-determined life in urban areas. This applies to urban residents as well as all other users of urban services, whether for economic or social interaction, education, health or tourism purposes.

5. Emphasizing equal access and inclusiveness is vital for poverty alleviation and the generation of social and economic opportunities for all. In the spatial sense and for the purpose of the preparation of a policy paper for the Habitat III New Urban Agenda urban services and technologies are oriented towards urban areas. This does not imply any spatial limitation to municipal boundaries but covers the urban-rural nexus, the interchange of people, services, tasks and needs. To take sustainable decisions on urban services, it is necessary to promote equal opportunities for all sexes in their diversity and use this as an opportunity for targeted action.

I. Vision and framework of the policy paper's contribution to the New Urban Agenda

6. The New Urban Agenda needs to outline concrete steps for cities and urban agglomerations to deliver on a number of major global targets and frameworks, notably the 2030 Agenda for Sustainable Development, the Addis Ababa Action Agenda, the Sendai Framework for Disaster Risk Reduction and the Paris Agreement.

A. Moving on from Habitat II

7. The Habitat Agenda provides the foundation for the New Urban Agenda by stating that "science and technology have a crucial role in shaping sustainable human settlements and sustaining the ecosystems they depend upon". It highlights that "the lack of adequate basic services, a key component of shelter, exerts a heavy toll on human health, productivity and the quality of life, particularly for people living in poverty in urban and rural areas". It identifies the related actions for

governments at appropriate levels to promote provisioning for adequate and affordable basic infrastructure and services.

8. Related to the transformative agenda for sustainable transport, Habitat Agenda partners committed to "improving access to work, goods, services and amenities, inter alia, by promoting effective and environmentally sound, accessible, quieter and more energy-efficient transportation systems and by promoting spatial development patterns and communications policies that reduce transport demand, promoting measures, as appropriate, so that the polluter bears the cost of pollution, taking into account special needs and requirements of developing countries". In spite of all progress during the last 20 years, this still holds.

B. Urban services delivering on Sustainable Development Goals and the Paris Agreement

9. The New Urban Agenda is key to delivering on the 2030 Agenda for Sustainable Development with all Sustainable Development Goals and the Paris Agreement. Equally relevant from an urban services perspective is the Addis Ababa Action Agenda regarding a framework for financing relevant infrastructure and the Sendai Framework for Disaster Risk Reduction to ensure that this infrastructure is resilient.

10. The New Urban Agenda closes the gap between the overarching frameworks and their concrete reference to a dimension for implementation: it provides the physical and geographical reference to these frameworks — urban areas stretching far beyond municipal boundaries and constituting an urban-rural nexus. It also provides the social, economic and environmental rationale — access, equality and the provision of development opportunities to all urban beneficiaries, both city dwellers and all other users of urban areas, regardless of their reasons for staying in urban areas, e.g. economic exchange, administration, education, health, visits and tourism.

11. The New Urban Agenda will be integral to the success of the Sustainable Development Goal framework given the cornerstone role for cities in achieving the goals. Goal 11, Sustainable cities and communities, refers directly to cities, recognizing their role as global economy powerhouses, drivers of innovation and centres of social interaction, making urban agglomerations indispensable in reaching the global ambitions encapsulated by the other Sustainable Development Goals.

12. This builds on the Rio+20 document, which recognizes the contribution of "water and sanitation within the three dimensions of sustainable development" and of the "importance of integrating water in sustainable development". The emergence of pollution control and wastewater management is part of the agreement. The Rio+20 outcome document also recognizes that transportation was central to sustainable development. It stresses the development of energy-efficient, multimodal and public transport systems and the importance of integrated policymaking at the national, regional and local levels.

13. The session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in 2015 (COP21) achieved a remarkable consensus on climate action. The Paris Agreement shows a clear attribution of the role of cities

and their specific contributions to implementing and measuring action. Ambitious steps are required to limit global warming to less than 2°C above pre-industrial levels. Cities are crucial in this context. A number of initiatives have been launched such as the Urban Electric Mobility Initiative (UEMI), the Global Fuel Economy Initiative, the Green Freight Action Plan, the Global Energy Efficiency Accelerator Platform, the Business Alliance for Water and Climate and commitments by the International Association of Public Transport (UITP) and the International Union of Railways (UIC) to demonstrate that action is being taken. Cities have a wide range of opportunities to contribute to such initiatives to boost local climate action.

C. 2030 vision for urban services and technologies

14. The above overview of the existing framework firmly links the 2030 vision for our planet with the role of urban services and technologies in the New Urban Agenda. The relevance of urban areas in achieving the Sustainable Development Goals has been widely acknowledged. The interlinkages between all relevant sectors as energy, transport, water, sanitation and waste management services have been strengthened. Integrated approaches of policies, programmes and plans have become a prerequisite for funding. Implementation on the ground constantly seeks to achieve synergy effects among the urban services and transport sectors. Wherever possible, services are delivered at local level. Smart city concepts are in line with integrated and sustainable development. Smart technologies are not considered as an end in itself, but enablers to adequately deliver urban services and infrastructure to the urban population. Technical norms and standards fully comply with the Sustainable Development Goals and do not determine political decision-making. They allow governments at all levels to decide on investment priorities, the bias being not on technological innovations but on benefiting the urban population. The New Urban Agenda provides space for the urban areas in the world to define their sustainability and level of technological "smartness" according to their legitimate yet individual principles of governance and government which shall best decide how cities want to develop in a sustainable way and improve their economic and environmental situation and their financial abilities.

15. Urban services take into account the increasing level of digitization and optimally use available knowledge, data and "smart" technologies as far as this contributes to serving the urban population and maintaining or achieving an equal and fair distribution of resources. Open access to information and data is crucial to democratizing technical contents of political decisions. Gender-responsive urban investments are planned and implemented with due consideration to gender dimensions and adequately addressing women's infrastructure needs, priorities and preferences.

Water, energy and resources

16. Everyone in urban areas has access to basic services, urban infrastructure and transport. Basic services, urban infrastructures, transport, and accessibility for everyone are recognized as the key triggers for people's development opportunities and a sustainable development of urban areas. Everyone has access to basic services, economic and employment opportunities, educational and health amenities in urban areas, without any discrimination.

17. Basic services need to be resilient, reliable and of appropriate quality, which cannot be provided by public authorities free of charge in the case of profit-oriented and greenfield developments of private developers and proprietors. Local authorities are fully mandated to collect investment contributions and fees to cover the full infrastructure and service costs. Mechanisms for cross-subsidizing of basic infrastructure have been introduced.

18. Energy for industries and households in urban areas is largely generated and supplied through renewable resources and distributed via a grid, allowing for minimal losses and high efficiency rates.

19. The focus is always first on reducing energy use and then using the energy most efficiently. Global, national, regional and local actions encourage non-fossil fuelled urban services, delivery and transportation.

Transport, mobility and access to urban opportunities

20. The quality of life in urban areas has improved significantly and cities play their role as catalyst of innovation by efficiently and smoothly linking people to places and activities.

21. All citizens have access to public spaces and services, economic, employment and educational opportunities and health services in urban areas, without discrimination.

22. Urban transport supports overall sustainability objectives through the delivery of resource-efficient, space-efficient, people-oriented, operational, clean and safe mobility, which adds to the quality of public spaces; negative externalities, such as congestion and greenhouse gas emissions, and fatalities or injuries due to urban traffic are minimized.

23. Sustainable transport infrastructure and services are adequately funded through contributions from users and indirect beneficiaries.

24. Urban areas are well connected with each other and with rural areas. Mobility is organized at the level of the metropolitan areas, beyond the administrative boundaries of cities, through adequate collaboration between relevant entities.

II. Policy challenges

25. Cities now account for more than half of the planet's people, with 30 per cent of all city dwellers living in slums. By 2050, urban populations are projected to increase to 6.3 billion (WWAP 2012). Developing countries account for 93 per cent of global urbanization (UN-Habitat 2010). Global gross domestic product (GDP) increased at an average of 3.5 per cent per year from 1960 to 2012 (World Economics, 2014), and much of this growth came at a significant social and environment cost. During this period, urbanization and economic growth, together with increases in production and consumption, generated increasing demands for urban infrastructure (United Nations World Water Development Report 2015, WWDR 2015).

A. States and trends of the thematic areas covered

Water, energy and resources

Water and sanitation

26. A quarter of the global population live in developing countries that face water shortages due to weak governance, deficiencies of professional capacities and a lack of infrastructure for water transport and treatment (WWAP 2015). Almost a fifth of the world's population (1.2 billion people) live in areas with physical water scarcity (UN-Water/FAO, 2007). 748 million people lack access to an improved drinking water source, while 1.8 billion people are without safe drinking water (WHO 2014, p. 1). In 2012, 2.5 billion people had no access to an improved sanitation facility. One billion people do not use any sanitation facility, defecating instead in the open (Sustainable Development Goals 2015); consequences for water and health are severe. By 2050, global water demand is projected to increase by 55 per cent, driven mainly by manufacturing, thermal electricity generation and domestic use (WWAP 2015). Increased demand for water can indicate positive economic growth but also implies huge challenges in allocating scarce water between and within industry, agriculture and the minor but yet decisive share of domestic water use. Increased water demand often marginalizes the poor population and excludes it from safe water accessibility.

27. The convergence of climate change and growing economic development in least developed countries is to intensify the water insecurity of the poor. OECD (2012) estimates that by 2050, water demand from manufacturing industries and thermal power generation will increase dramatically, especially in developing countries and BRICS. In the manufacturing industry alone, the total share of water demand by 2050 is expected to increase from 7 per cent to 22 per cent (WWAP 2015). In spite of outstanding advances in water provision in the last decades, over 80 per cent of wastewater worldwide is not collected or treated, and urban areas are the main source of pollution. 90 per cent of all wastewater in developing countries is discharged untreated directly into rivers, lakes or the oceans, causing environmental and health risks (WWDR 2015).

Energy and energy efficiency

28. Over 1.3 billion people lack access to electricity, and roughly 2.6 billion use solid fuels for cooking (IEA, 2012 in WWDR 2014, p. 13). Another estimated 400 million people rely on coal for cooking and heating purposes, causing air pollution and creating serious health implications when coal is used in traditional stoves (WWDR 2014, p. 13). Global energy consumption increased by 31 per cent from 2000 to 2013 (IEA 2015). Household energy consumption increased by 18 per cent (IEA 2013). The share of household energy consumption varies between regions; in OECD countries and Asia, housing represents 20-30 per cent of the total energy consumption whereas in Africa the share of household energy consumption is 56 per cent, in the Middle East 17 per cent and in Latin America 15 per cent (IEA 2013). In all regions, the absolute energy consumption of households has increased; the increase is very modest in OECD and Middle East countries. The major share of global energy production is generated from fossil sources, and the share of renewables has not increased globally in the last 13 years (IEA 2015). CO_2 emissions have increased 47 per cent over the same period (IEA 2013).

29. Global power generation continues to be dominated by thermal electricity production from coal, natural gas and nuclear energy production. The share of renewables is expected to double, accounting for 30 per cent of all electricity production by 2035 (IEA 2013). Wind and solar PV make up just 3 per cent of the global power mix. Although they are expected to grow rapidly over the next decades, they will probably not represent much more than 10 per cent of global electricity generation by 2035, not enough to achieve the climate goals (IEA 2012).

Waste and resources

30. The amount of municipal solid waste, one of the most important by-products of an urban lifestyle, is growing even faster than the rate of urbanization. In 2000, 2.9 billion urban residents were generating about 0.64 kg of municipal solid waste per person per day (0.68 billion tons per year). More than 1.3 billion tons of municipal solid waste was estimated to have been generated in 2012. By 2025, 4.3 billion urban residents are likely to generate about 1.42 kg/capita/day of municipal solid waste (2.2 billion tons per year, World Bank 2013). To this globally about a third of food produced for human consumption needs to be added due to its loss or waste, which amounts to around 1.3 billion tons per year (UNEP 2013, p. 13).

31. In developing countries, municipalities tend to spend 20-50 per cent of their available recurrent budget on solid waste management (World Bank 2011). Some 30-60 per cent of all urban solid waste in developing countries is uncollected and less than half of the population is served (World Bank 2011). In developing and emerging countries, collection coverage can be as low as around 40 per cent, compared to 98 per cent for developed countries (UNEP 2013). The global waste market, from collection to recycling, is estimated at $410 billion a year, excluding the huge informal segment in developing countries (UNEP 2011, p. 290). Recycling a ton of aluminium saves 1.3 tons of bauxite residues, 15 m^3 of cooling water, 0.86 m^3 of process water and 37 barrels of oil, which prevents the emission of 2 tons of carbon dioxide and 11 kg of sulphur dioxide (UNEP 2013, p. 13).

32. Some 3.5 billion people, or half the world's population, have no access to waste management services, and open dumping remains the most widespread waste-disposal method in most low- and lower-middle-income countries (UNEP 2013, p. 13). A ton of electrical and electronic waste (e-waste) contains as much gold as 5-15 tons of typical gold ore, and several times the amounts of copper, aluminium and rare metals found in typical ores (UNEP 2013, p. 13). Globally, organic waste decay contributes 5 per cent of greenhouse gases. Waste is a major economic drain, especially on city budgets: frequently, half of a city's budget is spent on waste management (UNEP 2013, p. 8).

Transport, mobility and access to urban opportunities

33. In contrast to the vision highlighted above, the current situation in many urban areas is far from ideal. In a significant number of cases, the mobility situation hinders sustainable growth and the quality of life of urban populations. Some of the issues are identified below, while the following subsection will look at the institutional and policy inconsistencies that have led to this state of affairs.

34. Developing and transition economies will see the bulk of population growth, with urban populations in Africa and Asia projected to rise by 90 per cent by 2050.

This will cause mobility demand to triple and place even more acute pressure on the current infrastructure and services in these countries.

35. Transport policies implemented in the past, as well as urban planning and infrastructure, led to an automobile dependence lock-in, with many destinations in or around cities requiring travelling for longer distances, making them reachable primarily, if not solely, by car. This has led to an imbalance in the use of different transport modes: private motorized modes of transport are dominant in developed economies and absorb an extremely high proportion of energy in comparison to their transport effects. The number of daily car trips in urban areas worldwide is set to increase substantially if no action is taken: from 3.5 billion trips in 2005 to 6.2 billion in 2025.[1]

36. While the appeal of private cars for urban populations in developed economies is starting to wane, urban areas in developing and transition economies increasingly embark in the trajectory of car dependency. This would not only impact developing and transition economies but have a strong global impact, notably in terms of resource consumption, greenhouse gas emissions, congestion and road risk. Fossil fuelled transport needs to be drastically downscaled in favour of sustainable transport modes for passengers and goods.

37. Cities are increasingly confronted with levels of traffic congestion, offsetting the benefits of agglomerations and negatively impacting their attractiveness and competitiveness, as well as citizens' well-being. In the European Union, the 2011 White Paper on Transport estimated the cost of road traffic congestion at nearly 100 billion euro annually, approximately 1 per cent of total European Union GDP in 2010. It is very useful to note the disproportionately high cost this is putting on the economic value produced in the urban area itself, particularly in developing cities. A 2014 study estimated that losses due to congestion in the metropolitan areas of São Paulo and Rio de Janeiro alone have reached a billion Brazilian real, 8 per cent of GDP produced in the two areas. The settlement structure, increasingly characterized by urban sprawl, creates unnecessary traffic. However, cities in developed countries are starting to reverse the sprawling trend.

38. Motorcycles and mopeds are taken up as a regular means of transport, particularly in developing countries, as an alternative to private car use. However, they add further externalities to urban transport, decreasing the quality of life in urban areas, primarily due to additional pollution (both noise and air quality) and higher levels of road risks.

39. Disadvantaged groups within the urban population, particularly the poor, cannot take full advantage of the urban opportunities and services — including public spaces, health, education, meaningful employment — as the distances and costs associated with urban travel restrict their full access and participation. Social inequalities become sharper instead of being attenuated.

40. Policies prioritizing the use of private vehicles limit the potential to improve the quality of urban life and promote social interactions. In these cases, urban mobility has negative effects on quality of life and the overall livelihood in the city. Poor quality of urban life has many aspects, including unacceptably high risks: 380,000 road deaths were recorded in urban areas in 2005. Roads are primarily

[1] UITP 2011, Towards a smart future for cities: urban transport scenarios for 2025, *Public Transport International Magazine*, May/June 2011.

designed for car use without taking into account the needs of vulnerable road users. The World Health Organization states that 90 per cent of the total number of road deaths occur in developing countries, where most of the urban growth is expected: road safety needs to improve by fostering safe behaviour of road users, infrastructural improvements and promoting safe vehicles. Other externalities refer to bad air quality coming from tailpipe emissions, as well as noise pollution from the car engines. Furthermore, the lack of physical activity associated with using private cars as the main mode of urban travel puts a high burden on health-care systems.[2]

41. The current pattern of vehicle use in cities is inefficient, in terms of both passenger and goods transport. Public transport vehicles are underutilized at off-peak times, leading to high service provision costs. On the other hand, private vehicles are parked about 95 per cent of the time, and when they are moving, the average occupancy rate of private cars — usually having four seats — is well below two passengers per car. Technological innovations and better data on transport demand and supply can improve these inefficiencies. The development of the sharing economy, combined with the digitalization of urban mobility, offers an opportunity to reduce car ownership and use vehicle capacity in a more efficient way.

B. Policy issues and challenges

42. The overarching challenge for urban services and technologies is to apply a participatory approach in the form of inclusive partnerships at different levels of government and among the relevant stakeholders and the public. Further key challenges lie in fostering growth and overall development while guaranteeing equal access for all urban beneficiaries to urban services and transport.

43. All relevant sectors tend to claim a dominant role (water, waste management, energy, transport, etc.). The challenge lies in establishing a joint understanding of integrated sustainable urban development showing the sectorial interdependencies and providing for priority setting and the mobilization of synergies among the sectors. Sectorial approaches need to recognize that the "win" for the one predominantly means a "loss" for the other, i.e. optimizing water supply for one area often implies a lack of basic supply for another, mechanizing waste management means marginalizing the informal waste sector, optimization of traffic standards lowers the quality of public space, etc. This highlights the need for integrated and cross-sectoral approaches for urban services and mobility.

44. Investments for urban services need to consider and understand the investment rate of technological and innovative solutions and bring them in line with the requirement to serve all urban beneficiaries. The resilient design and implementation of urban infrastructure requires weighing and decisions on the dilemma whether to opt for more flexible, "robust" low-tech structures that can easily be repaired or re-established after disasters or technologically more sophisticated infrastructures with a higher level of redundancy to sustain disasters.

45. In this context, international and national norms and standards also pose a relevant challenge: the setting of standards and norms through the International

[2] UITP 2016, Unlocking the health benefits of mobility.

Organization for Standardization (ISO) and other norming institutions (IEC on electrotechnology, ITU for telecommunication) under the umbrella of the World Standards Cooperation has an enormous influx on investment patterns of public administrations and the private sector. In the context of the New Urban Agenda, this plays a vital role as most of the investments in urban services are subject to technical or even non-technical standards.

46. Provision of urban infrastructure and services, especially in greenfield development, is commonly not based on a full or even part cost recovery, absorbing local government resources that would be better allocated to service provision for the urban poor.

47. Conventional finance mechanisms and financial resources are insufficient to meet the costs of establishing and extending urban infrastructure and basic services. This also holds for the operation and maintenance of facilities. Proper transfer through transparent, accountable and legally sound procurement and delivery processes requires a global consensus on transparency, sound procurement procedures and quantitative and qualitative controls on delivery patterns.

48. Often, the transfer of tasks related to urban services to the responsibility of local authorities (principle of subsidiarity) does not go hand in hand with the simultaneous transfer of political mandates, administrative structures, financial resources and room for local decision-making. Common to all areas of the provision of urban infrastructure, basic services and transport is the frequently inefficient use of available resources. The challenge is to carefully integrate sectors, take into account life-cycle costs and sustain investments in areas with the best effects on accessibility for all urban beneficiaries, social inclusiveness and technological appropriateness.

49. Often, gender-responsive urban investments are not designed and implemented according to gender dimensions and adequately addressing women's infrastructure needs, priorities and references. Within this scenario, it is also necessary to recognize the increasing incorporation of women into the labour market and the lack of investment and mechanisms for adequate security on public transport as a measure against harassment and sexual violence in transport.

50. Policy issues and challenges refer to the visions above. To achieve them, the following challenges have to be dealt with:

Water, energy and resources

51. The investment gap towards basic water, sanitation services and energy supply (construction of basic infrastructure) urgently needs to be bridged.

52. Although renewables are increasing in proportion to conventional energy, they remain underdeveloped and undersubsidized in comparison to fossil fuels (WWAP 2014). The production and distribution of energy tends to be highly centralized, also in areas with obvious opportunities for delivery and improvement through decentralized schemes based on renewables.

53. Reducing the demand for both materials and energy while enhancing access to household energy among the urban poor is a major challenge.

Transport, mobility and access to urban opportunities

54. The issues highlighted above are primarily the result of a number of structural policy elements, notably inconsistencies between policies at different levels, which lower the quality of urban life and access opportunities available to urban populations.

55. While the main goal of urban mobility policies is to provide access to opportunities and amenities, there is no systemic perspective on urban mobility. Transport and land use planning, environmental or urban economic development policies are usually not interconnected and coordinated, despite local authorities generally being responsible for these policies.

56. In a number of countries, competence for planning and procuring urban mobility services has been devolved to the local level, but without sufficient funds being allocated or the competence to raise or decide on funding being devolved simultaneously.

57. While promoting public transport use, decreasing congestion or improving air quality often are priorities at the local level, the user costs of private motorized transport modes do not reflect their full costs, notably due to the widespread subsidisation of fuel prices, which is decided at the national level. Conversely, while social protection and equality may be a priority of national level policies, practices related to urban development and planning at local level may sometimes create or perpetuate social inequalities (e.g. lack of adequate access to amenities or service provision in poorer neighbourhoods).

58. The necessary appraisal of transport projects and options is complicated by the lack of assessment frameworks (ex ante, ex post) and the difficulty and cost of collecting relevant data. In some cases, projects are pursued according to political or individual preferences, rather being guided by an evidence-based assessment of their benefits in terms of access to urban populations.

59. The benefits of providing access to urban opportunities through sustainable transport means are difficult to estimate and quantify. As such, both public authorities and private entities tend to view sustainable transport of goods and passengers as a cost rather than an investment.

III. Prioritizing policy options: transformative actions for the New Urban Agenda

A. Targets

60. Targets should be interlinked with the adopted Sustainable Development Goals, COP21 goals, the outcomes of international conferences and national policy-setting. In addition targets also need to reflect the ambitions linked with the expansion of urban services and the improvement of urban transport towards better urban environments and living. Ambitious targets as: full coverage of urban areas by urban services which comply with basic standards up to the end of the decade, halt of open waste dumping sites within 5 years' time, urban transport's greenhouse gas emissions reduced by 50 per cent in 10 years' time, etc. To ensure effective implementation, these targets should be aligned at the local, national and global levels and should be backed by broad consensus. Ambitious targets can set the direction of current and future action, and are useful to show governmental commitment and to send a clear message to the market.

Linkages between the thematic areas covered and the Sustainable Development Goals

61. The links between the Sustainable Development Goals agreed at the global level and the New Urban Agenda highlight the role envisioned for urban services, mobility and technologies in fulfilling them. These links show the interconnectedness between global goals and the urban fabric and the role urban services play in making the most of this relationship. The New Urban Agenda should recognize that the Sustainable Development Goals' urban dimension is much broader than Goal 11. Goal 11, Make cities and human settlements inclusive, safe, resilient, and sustainable, targets other Goals. In particular, Goal 3, on health, Goal 5, on gender, Goal 6, on water, Goal 9, on infrastructure, Goal 13, on climate, and Goal 17, on implementation, are strongly linked to Goal 11 (Habitat Unit/TU Berlin 2015). Urban services can make a substantial contribution to sustainable development, reducing poverty, improving health, equality, protecting the environment, biodiversity, combating climate change and improving the quality of life in our cities. However, unsustainable transport can significantly impact on many of the Sustainable Development Goals, too. This is vital to consider in planning urban services systems.

Linkages between the thematic areas covered and results of COP21 goals

62. The COP21 agreement aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty. This requires keeping the increase in global average temperatures to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change. The decarbonisation of the energy and transport sectors has a vital role to play. It needs to be pursued closely not only in view of the objectives set on access to safe, affordable, accessible and sustainable urban development but also to add the contribution of the urban sector to the climate objectives and the related decarbonisation to mitigate further climate change. Finance will play a vital role here, and the Green Climate

Fund and the Addis Ababa Action Agenda have a key role to play in this context, which also includes enabling cities to directly access international, multilateral and bilateral climate finance and development cooperation funding sources.

Linkages between the thematic areas covered and results of Habitat II

63. Habitat II emphasized the need to combat the deterioration of living conditions within human settlements, which is needed to address unsustainable consumption and production patterns; population changes, including changes in structure and distribution, considering the tendency towards excessive population concentration. Furthermore, the lack of basic infrastructure and services and adequate planning, growing insecurity and violence, environmental degradation, and increased vulnerability to disasters need to be addressed.

64. Habitat II also strengthened to extend adequate infrastructure, public services and employment opportunities to rural areas in order to enhance their attractiveness, develop an integrated network of settlements and minimize rural-to-urban migration. Habitat II promoted full accessibility for people with disabilities, as well as gender equality in policies, programmes and projects for shelter and sustainable human settlements development.

Criteria

65. In keeping with the vision of urban services and transport that was expressed in Section 1, the following values and criteria have to be kept in mind when designing and implementing urban mobility policies.

66. A key criterion for the selection of policy priorities relates to striking a balance between individual and collective goals. From an urban services and transport point of view, most of the policies previously adopted have favoured individual goals over collective goals.

67. Sustainable growth should be at the core of urban service and mobility policy. Sustainability can foster the streamlining of policies to provide better urban services and more public transport using clean fuel technologies. Furthermore, as discussed above, urban services and transport should act as a lever for growth, and policymakers should ensure that sustainable urban services and mobility also leads to economic growth.

68. Equity and affordability should be observed in all service- and mobility-related policies, because access to urban opportunities should be provided equitably. This criterion is particularly salient in the wider context of favouring social integration and inclusion, and it is important to note that good urban services and public transport connections strongly favour the development and improvement of the human capital within cities.

69. A key criteria for a balanced and integrated approach to deliver on the Sustainable Development Goals and climate targets is to mobilize stakeholders and resources for all urban services, strengthen the administrative structures through capacity-building and develop workable governance structures to boost implementation action.

70. Decentralization is the prerequisite to deliver urban services applying the principle of subsidiarity, giving responsibilities and resources to the appropriate

level of government, putting cities and municipalities at the heart of urban service delivery. Investment decisions can then be based on criteria such as equality, fit-for-purpose service delivery, resilience, the generation of economic and social opportunities and cost-recovery considerations.

B. Policy priorities

71. Based on these overarching targets, policy priorities arise to deliver the stated objectives. The following policy priorities refer to visions and challenges above.

Water, energy and resources

Water and sanitation

72. Urban water services (water supply, drainage, and wastewater) need to be developed to match the natural resources and soil available in order to provide a sustainable service. Water services demand should be matched with the natural risks, resource availability and protection through choices made in urban design of buildings and neighbourhood (cascading uses of water, rainwater harvesting, grey water recycling, wastewater collection and treatment, etc.) which shape the urban form. Once basic infrastructure is supplied and operational, water and sanitation systems need to be developed towards full operational cost recovery but taking into account the social impacts of their pricing.

73. In order to avoid waste of water and an unequal distribution of water resources, pricing systems incentivizing the efficient use of water in the agro and mining industry need to be introduced which reflect the water footprint.

Energy supply and energy efficiency

74. Energy efficiency and access to renewable energy sources needs to be achieved with a focus on the synergy of various areas. The key objective is the decarbonisation of energy production, distribution and consumption. Central and decentralized energy systems should be integrated, and two-way energy networks should be efficiently used. When more fluctuating power supply is increasing (solar, wind), it is extremely important to ensure efficient demand side measures and smart control systems. In addition, long- and short-term energy storages are gaining significance.

75. It is essential to manage the transition to sustainable energy supply and delivery. The challenge lies in managing the increasing energy demand while enhancing access to household energy among the poor at the same time.

Waste and resources

76. Access to decentralized waste management systems needs to be provided, and alternatives to unregulated and inappropriate forms and locations of unregulated disposal of waste (open burning, landfilling without groundwater protection) must be pursued.

77. Waste needs to be treated as a resource, and "circular economy" mechanisms have to be established. Decent work among a formalized waste collection and recycling system and informal waste workers and recyclers, ensuring a coherent,

efficient and dignified system for waste collection, recycling and disposal are a prerequisite for the acceptance of a coherent waste policy.

Transport, mobility and access to urban opportunities

78. Starting from the criteria given above, the following priorities should be set in terms of urban design and access to city opportunities and services.

79. Compact, dense and inclusive urban design, mixed land use, as well as the integration of transport and land-use planning, should be promoted. The goal should be to reduce the distances travelled to enjoy and take advantage of urban opportunities. This includes controlling and reversing urban sprawl and prioritizing urban development in areas already served by public transport services. Wherever new urbanization is to be implemented, the concept should include public transport and non-motorized mobility.

80. The quantity, quality and integration of sustainable transport options in urban areas should be improved. This includes three different elements:

(a) Investment in infrastructure dedicated to public transport services, walking and cycling and other upcoming forms of moving as well as improving facilities for non-motorized travel modes;

(b) The promotion of a more efficient use of existing infrastructure, exploiting the potential of digitalization of urban mobility as well as shared mobility;

(c) Improving sustainable travel options, making the travel experience by collective and public transport modes a seamless alternative to private car travel.

81. The demand for private motorized travel should be managed and urban transport rebalanced in favour of people rather than vehicles. Priority should be given to sustainable travel modes which reduce the cost of transport for the community and the negative externalities of urban transport.

82. A resilient and predictable mix of funding sources for sustainable urban travel should be achieved. Efforts should be taken to better internalize the costs of various modes of urban transport, and revenues directed towards sustainable modes. Infrastructure investments should also prioritize sustainable travel in the attempt to decarbonize urban transport.

C. Critical recommendations for implementing the urban agenda

83. A New Urban Agenda requires policies, programmes, projects and measures to be taken in a systematic multilayer approach interlinking activities of governments, regions and the local level. A range of measures need to be regarded as a prerequisite for change. In addition, a variety of immediate activities are needed to generate a "momentum of change" with some "quick wins". This also encourages all related parties to enter the "agenda of change" as early as possible.

84. A range of cross-sectoral recommendations prove valid for all sectors. Out of these, one administrative issue appears to be relevant: inter-municipal cooperation and shared services offer an alternative full service delivery by one municipality through the division of responsibilities and task sharing. Inter-municipal

cooperation can work as an arrangement between two or more local governments and support the provision of urban services and transport, gain substantial advantages through the economies of scale or solve problems the cities and their hinterland have in common. The following section provides additional sector-specific recommendations.

Water, energy and resources

Water and sanitation

85. Assess the water-related risks and resource limitations and maximize the advantages of the natural environment prior to planning the city development, so that the limitations may be accommodated, the natural potential best valorised and risks mitigated, while synergies with other sectors are implemented for maximum efficiencies.

86. Launch an integrated water planning approach to manage urban-rural linkages, minimize conflicts and ecological disasters as well as to maximize positive synergies and mutual benefits, at local and regional scales.

87. Make the best use of waters through an integrated water cycle approach, limit the resource movement, maximize its reuse by drawing it from diverse local sources, optimize its productive use (e.g. by using water at qualities that are fit for purpose), prevent pollution and treat "waste" as a resource (for energy and materials) and by fostering synergies at the water-food-energy nexus.

88. Plan adaptive urban water systems with the necessary resources to build greater adaptive capacity to respond to the inherent uncertainties associated with global change issues.

89. Assure public health through strong local leadership and adequate investments in sanitation infrastructure and services, develop citywide universal sanitation access strategies and apply innovative, context-specific and culturally sensitive solutions.

Energy supply and energy efficiency

(a) Promote an immediate and strong shift towards a low-carbon energy system in line with a 1.5°C stabilization pathway;

(b) Boost energy efficiency by optimizing building-related energy consumption, improved industry processes, business and households, district cooling and efficiency through cogeneration (block or district heating networks);

(c) Consider increasingly different energy aspects jointly, as heat and electricity supply in conjunction with mobility and waste-to-energy technologies;

(d) Create opportunities for developing countries to leapfrog to renewable solutions for energy storage and warming water; e.g. Solar power and local small-scale smart grids in rural areas where conventional power lines do not exist;

Waste and resources

(e) Take a circular economy approach, emphasizing waste prevention, source separation and the use of waste and waste products;

(f) Facilitate urban mining and the reuse of wastes; establish material recovery facilities;

(g) Ensure the appropriate, transparent and prudent management of hazardous waste in line with international treatment and health standards;

(h) Establish extended producer responsibility schemes that include producers in the financing of urban waste management systems and reduce the hazardousness of waste streams and recycling rates by better product design;

(i) Develop local waste prevention concepts that take into account the specific urban metabolism and focus on the most urgent waste streams with the highest cost-saving potentials.

Transport, mobility and access to urban opportunities

90. Setting the priorities described above requires concerted action from a large number of stakeholders who are involved in urban mobility, whether directly or indirectly. This section will make recommendations, for each priority area, on how the array of stakeholders should work together to achieve these priorities.

Urban design and planning

91. Local governments are one of the main institutional actors in this priority area, but they are definitely not the sole actor involved. Promoting compact, dense cities requires an urban land-use plan linked with a transport plan for the city prioritizing the multifunctional neighbourhoods and spaces within the city that can be reached easily through public transport.

92. Local authorities must foster cooperation and provide the conditions to create a mutual understanding between transport and urban planning departments.

93. At the same time, local administrations must have the necessary knowledge and capacity to draft a transport and land-use plan, and the legal capacity to enforce it upon adoption.

94. In many cities, both in the developing and developed countries, basic land inventory information, such as a cadastre, is not readily available, and local administrations should have the support of the national (or regional if relevant) and international level to obtain and make good use of such data and information.

95. Land-use and transport plans are most effective when they are covering the most appropriate scale, also taking into account regional travel and urban-rural linkages. As such, a strong framework and culture of cooperation should be created for cities and municipalities in the same metropolitan area.

96. In places where infrastructural needs are acute and the capacity for action at both local and national level is missing, international institutions (such as United Nations agencies and multilateral development banks) also have a role to play as well.

97. Yet plans set the main framework for investments in the cities. They also have to be signed up and "appropriated" by private business and civil society to be successfully implemented. For example, to promote transit-oriented development, a fine balance needs to be struck between offering land developers incentives to develop next to high-capacity lines and capturing the extra value that public

transport would bring to the land itself through the agglomeration of activities around stops. Transport companies, whether incumbent operators or private ones (even if informal), should also be involved to make the best use of connections, setting up feeder services and multi-modal connection facilities needed for seamless door-to-door travel.

Increasing the quantity and quality of sustainable travel options

98. Infrastructure investments in urban projects should be decided upon according to the benefits they bring to the area. For urban transport infrastructure projects, access is the key benefit, but — in accordance with the values above — the goal should be appraising the benefits in terms of access for people, rather than for vehicles. Current frameworks for appraisal should be adapted to adequately reflect the wider economic, quality of life and accessibility benefits of sustainable travel and road safety. It is important that all such projects are appraised using a common framework, and that the local authorities (who would propose the projects in question) are capable of estimating and identifying the benefits of sustainable transport infrastructure.

99. Cooperation with academia is a very important aspect in the goal of raising the efficiency of the use of current infrastructure in order to increase its resilience and adaptability. As technologies often hold the key to using existing urban infrastructure more efficiently, it is important that regulators, (innovative) businesses, researchers and transport providers work in tandem to ensure that the right framework is in place to better use the transport infrastructure to attain sustainable, people-oriented urban mobility.

100. Good governance and coordination, underpinned by technological solutions, is also required to improve the quality of sustainable mobility services. Starting from the assumption that mobility policy should be based on equity (as included in the criteria for priorities above), the key recommendation is that both mobility providers and regulators cooperate to provide sustainable travel conditions and services which allow convenience and flexibility similar to what car travel has up to now. Local authorities and mobility providers in metropolitan areas must have a clear and enforceable contractual relationship defining the obligations of both parties related to requirements of service and remuneration.

Managing the demand for private motorized travel

101. Setting up access restrictions or congestion charging schemes, which discourage private cars and motorcycles from entering certain neighbourhoods, helps reducing congestion, as well as sound pollution, improving air quality and reducing road risk that stem from private motorized traffic. It is paramount that accessibility to an area is also provided through sustainable modes and that any revenue from such schemes is reinvested into improving access and transport options. National Governments should adapt legislation to allow the creation of restricted traffic zones within cities.

102. The availability and price of parking is an important element in determining modal choice for people in urban areas. Removing minimum parking requirements for development of residential and commercial locations would reduce building costs and increase the amount of space that is available. As such, local authorities

could seek out alliances with land developers and the business community in the city for such policies.

103. It is also important that the goals of local and national policies are aligned to promote sustainable travel options in urban areas. In particular, subsidized fuel prices, or tax advantages for car ownership (company cars) should be abandoned.

Secure adequate funding

104. As providing access to urban amenities and opportunities requires funding — both as infrastructure investments and as funding for the maintenance and operation of services — stable sources of income should be found. Clear frameworks of cooperation should be put in place to ensure that while local authorities are being given responsibilities for the planning and provision of services, they also have a matching ability to raise the required finances to actually deliver. Furthermore, local governments should maintain open and transparent avenues of dialogue with local businesses, which benefit when cities are more accessible. As indirect beneficiaries of sustainable mobility, the latter should also be involved in providing a share of the funding for sustainable mobility services in metropolitan areas.

IV. Key actors for actions: enabling institutions

105. This section will build upon the critical recommendations highlighted in section III.C by mapping out the players and stakeholders who would ideally be involved in the policymaking process. Furthermore, the envisioned links, relations and interactions between the actors in order to transform policy priorities and outcomes successfully will be highlighted. While the stakeholders will be mentioned as a list starting from the highest to the lowest level of aggregation, the relations between them should not be hierarchical but cooperative and based as much as possible on an equal footing.

A. Public administration

National Governments

106. National Governments should recognize that urban areas represent the powerbases of national competitiveness, productivity and growth. The higher quality of life that provides the availability of urban services such as water, energy and waste management attract urban populations, concentrating the potential for growth in cities; as such, national Governments should enable local administrations to provide these in a sustainable fashion, using technology to address resource finiteness. Furthermore, national Governments should work with city representatives to ensure that urban mobility policies serve their purpose of unleashing this development growth potential and identify ways in which obstacles to productivity and economic development — such as traffic congestion, lack of accessibility and high road risks — can be removed.

107. The role of national Governments is critical in providing funding, as is a critical appraisal of projects and strategies that require major investments. This includes both investments in services that improve the quality of living conditions in cities (provision of energy, water and sanitation and waste management) and

those providing access to urban opportunities (sustainable transport infrastructure and services).

108. National Governments should recognize the intrinsic link between the spatial layout and geography of urban areas and access urban populations have to opportunities within cities. In doing so, they should support the integration of land-use planning and transport policies at local level. Setting up and maintaining a land-use inventory, which local authorities can access, is an important prerequisite.

109. National Governments should — in cooperation with international institutions if needed — set up a national urban infrastructure funds with the express goal of enabling cities to work towards reaching target 11.2 of the Sustainable Development Goals. Eligibility for such funding should be linked with the implementation of integrated urban development strategies (such as sustainable urban mobility plans), and the decision on disbursing and approving the funding should follow an appraisal procedure taking common elements into account.

110. Cooperation between national and local-level governments should take place in a well-defined framework considering the potential to create value that the provision of urban services and transport projects bears for private businesses in urban areas. Cities should be allowed to capture a share of this value and mandated to reinvest it into urban services to improve the quality of life within the area.

111. Additionally, through their fiscal and regulatory powers, national Governments have a key role in shaping the scene for urban services and mobility policies. National legislation should clearly set the way in which urban services and mobility policies are being defined. Legislation deciding on the powers, responsibilities and funding streams available to local authorities that manage service delivery and mobility in urban areas is needed to offer clarity and set the rules of the game for local-level governments.

112. Fiscal policies and taxation, for which national Governments have nearly exclusive authority, are important levers for shaping the construction, operation and maintenance of urban services and transport in urban areas. Taxation and subsidies from the national level should focus on promoting sustainable urban services and mobility, while also lowering the costs per capita of urban services and transport.

113. In this respect, national and local governments should coordinate to align their urban services (for example by jointly defining minimum service standards) and transport policy goals (for example by complementing travel demand management policies at local level by reducing any fuel subsidies or reducing incentives for companies to offer company cars). Having signed up to the ambitious Sustainable Development Goals and targets, national Governments should cooperate with other stakeholders to reduce the level of energy consumption and carbon footprint of urban mobility systems.

Regional and local governments and authorities

114. Local governments are key to improving urban services and transport. To foster public policies in public services and transport delivery and in view of the increasing technical and financial constraints, policy dialogue and continuous collaboration among all levels, with the private sector and the communities, needs to be initiated by regional or local governments as they have the responsibility to serve the urban beneficiaries. The dialogue incorporates key stakeholders (central

Governments, service operators, trade unions, civil society) and can result in drawing up charters defining roles and responsibilities, financing and management and minimum standards to set qualitative and quantitative levels and standards of urban services and transport in line with the sustainability goals.

115. To contribute to strengthening urban services and transport, the effectiveness of regional and local government departments and public providers must be improved by investing in human and technical resources and implementing appropriate management systems and technologies.

116. When urban services and transport provision is entrusted to external partners, regional and local governments should be active and demanding partners in order to ensure universal access to services and preserve public goods. They need to develop and maintain the internal capacity to monitor and provide oversight to ensure that access, quality and tariffs meet the needs of citizens. For many cities, this requires a collaborative approach with other cities to upgrade their capacities and promote these tasks.

117. Local governments should acknowledge the role played by small-scale and informal operators in basic service and transport provision and promote co-production of basic services with local communities, particularly in informal settlements and slums. They should assume responsibility for monitoring quality, harmonizing prices and coordinating service delivery with official providers to avoid provision gaps.

118. Local governments should be aware of the potential impact of new urban infrastructure on the preservation of cultural heritage, cultural practices and symbols. Cultural impact assessment tools should be used to carry out an ex ante analysis of potential negative impacts, and a precautionary principle should apply whenever necessary.

119. The urban-rural and urban-urban interlinkages in all fields of urban services and transport highlight the importance of coordination between local governments in the same metropolitan area or region. The successful design and implementation of strategic infrastructure and mobility policies at metropolitan or regional level requires a good level of cooperation between local governments as well as with national Governments.

120. Furthermore, local governments are best placed to integrate urban infrastructure and mobility with other local policies and objectives, particularly housing and land use policies. Decisions on housing, building permits and zoning regulations will strongly affect the provision of urban services, mobility and transport in the city, so it is paramount that the relevant departments coordinate their actions and policy goals.

B. Stakeholders

Operating companies, urban services and mobility providers

121. Due to their practical expertise, companies providing urban services and transport services to urban residents should be involved in the policymaking process regarding transport policies. Furthermore, given their direct relation with customers,

such companies are familiar with consumption and travel behaviour and preferences, which can be fed into policymaking processes.

122. On the other hand, public authorities and not the private sector, particularly at the local level, should strive to formalize organized transport within metropolitan areas by setting standards and guidelines that professionalize the sector and improve travel across the city.

Stakeholders, beneficiaries and civil society

123. Urban service and mobility policies, programmes and plans need to be developed in close collaboration with stakeholders, beneficiaries and civil society. Without the integration of bottom-up aspirations and demands, policies, programmes and plans tend to remain fragments. Making investments in urban services and mobility among the urban population a success requires a broad consensus on the rationale, goals, objectives and means.

124. Civil society groups and various associations play an important role in shaping and influencing consumption pattern (water, waste, energy) and travel behaviour, and can consequently support authorities in reaching their goals, particularly on moving towards sustainable consumption patterns and travel modes.

Private developers, the business community, and service providers

125. Private developers for real estate can add to the value of urban services provided they pay for the urban services rendered based on a full cost recovery or add to the urban infrastructure in line with the quality standards set by the local bodies. On the other hand, private developers may not escape with windfall profits from increasing land prices and real estate development in the formal and informal housing economy without contributing to urban services and public amenities.

126. The business community has a lot to gain from adequate urban infrastructure and efficient urban mobility services as better services, connectivity and transport links enable businesses to gain access to a wider and more diverse workforce, offering better productivity.

127. Additionally, as transport amounts to lower transport costs for the community (as a share of the GDP produced within the urban area) in cities less dependent on private car travel,[3] businesses stand to gain from the higher purchasing power of the urban residents. The business community should cooperate with authorities at both national and local levels to reinforce this virtuous circle and participate in the funding of inclusive, equitable and sustainable urban mobility projects. Moreover, as improved public transport connections offer more opportunities for residents to access urban services, the value of land and buildings in well-connected areas increases. Businesses stand to gain from this increase in the physical capital within the city and should be encouraged to support public transport projects.[4]

[3] Extract from UITP, Mobility in Cities Database, 2006. The cost of transport for the community is defined as the sum of public transport operation and investment expenditure, road building, maintenance and operations expenditure, as well as expenditure for the operation of private vehicles (fuel, insurance, parking, amortization, etc.).

[4] Reference to literature on physical capital.

128. Privately organized service providers play a decisive complementary role to the public sector if they operate efficiently and in line with clear-cut performance and delivery standards. These need to comply with the overarching objectives set at the different government levels. They need to be monitored closely and are obliged to report to their public clients.

129. Businesses are more likely than public authorities to be among the early adopters of new technologies that could improve the quality and efficiency of urban services. Through cooperation and engagement with the research community as well as authorities, businesses in the metropolitan areas can act as "test beds" for technologies before they are rolled out at city level.

Housing agencies and cooperatives

130. Housing agencies and cooperatives can cater for a considerable proportion of urban housing needs primarily for the lower income groups while also being partners in the provision of urban services, their (co-)financing, management and operation. Cooperatives often play a role in the transport sector and can be part of a multimodal urban transport policy. They are usually highly adaptive to changing needs and requirements and can complement the public transport services.

131. Cooperatives can also contribute to waste management as an intermediary between formalized public or private waste services and the informal sector. They are ideal means to maintain a high job rate in the waste sector and have proved highly flexible and efficient in adapting to waste management requirements if properly integrated into the waste management economy.

C. International community and academia

International community, multilateral banks, city networks and institutions

132. International institutions play a key role in helping actors at both national and local levels build capacity and knowledge to identify and implement strategic urban services and transport projects. Capacity-building is also relevant from a governance point of view, and international institutions can offer assistance in the building of institutions that facilitate good cooperation between local actors.

133. They also provide support in the setting of the policy agenda for national Governments and other stakeholders. Furthermore, they are well placed to gather, analyse and disseminate knowledge of policy options and trends from all over the world. The role of international institutions is essential in identifying good practice examples at urban as well as national level.

134. Through their inclusive and participatory structures, international institutions can act to facilitate the exchange of knowledge. The knowledge should be linked to capacity-building. From their position of gathering knowledge, international institutions are also in a good position to observe where knowledge gaps exist, and should be working with the stakeholders involved to develop the capacities needed to fill these gaps.

135. The measurement and appraisal of urban services and mobility outcomes is an area where international institutions should cooperate more with both governmental actors — at national and local level — and with civil society, academia and the

business community to develop this capacity. At the same time, international-level actors and institutions can also work with governments and authorities at national and local levels to help the latter set up a workable framework for the sharing of responsibilities and competences regarding urban services and mobility, particularly related to funding arrangements. International institutions also play an important role in mobilizing private funding for urban services and mobility projects, and can foster cooperation between governmental actors and civil society and academia for the successful design and implementation of urban mobility strategies.

136. In addition to the international financial institutions, such as multilateral development banks, have a key role in financing, providing technical cooperation and advising national, regional and governments in urban mobility matters.

137. International, regional and national city networks play a key role in designing, requesting and supporting frameworks for effective and sustainable urban services.

Academia

138. Apart from their general role in improving the skills and qualifications of the (future) workforce, thus improving human capital available within cities, universities provide unique knowledge in terms of generating knowledge related to the appraisal of the outcomes of urban services and mobility policies and strategies.

139. Academia has a central role in providing and fostering innovation, which can be applied or implemented directly. Innovation should not be limited to technical or engineering aspects. Innovation in e.g. organizational and governance fields as well as marketing can be beneficial for both transport and other urban services. Private and public actors should take advantage of, and foster good relations with, the research community.

V. Policy design, implementation and monitoring

140. The derivations from the vision, challenges and priorities should become the basis for the monitoring of design and implementation of the key actions that anchors the New Urban Agenda on urban services and technologies.

A. Policy design, governance and technologies

141. The realization that urbanization represents a unique opportunity to be harnessed to support economic growth and social advancement has grown in the last decades. This makes it more imperative to acknowledge the diversities in the urban sphere and ensure that governance, planning, design and implementation for urban services are driven by multilevel governance, decentralized local governance, and inclusive, accountable, participatory and people-centred principles.

142. Decentralized policies could provide expanded mandates and resources to local governments. However, the gap between allocated responsibilities and the capacities to implement the policies must be aligned to local revenue generation. This is a huge challenge for their credibility towards their citizens.

143. Achieving good governance requires that local government, civil society and all stakeholders involved in knowledge, industry, technology and finance are given

equal opportunities at the same decision-making level for their cities. Appropriate legislations, regulations and policies as well as enforcement mechanisms are relevant to anchor and sustain inclusivity, participatory decision-making and collective monitoring and evaluation of city development.

144. The New Urban Agenda framework has to focus on technologies, since it is a crucial element of urban infrastructures and offers many opportunities. The availability of (digital and physical) infrastructure and the use of big data is important for the future development of cities and their ability to cope with challenges. As new infrastructure technologies evolve and become increasingly inter-linked, their co-evolution needs to be considered holistically if cities are to fully optimize the overall benefits of innovative urban infrastructure systems.[5]

145. In this context international standardization as a crucial condition for scaling and replication can contribute to strengthening the possibilities for the utilization of technology for urban challenges. Standardization should be set up in such a way that it sustainably guarantees competition among multiple vendors and systems. Therefore, it should be defined to create open infrastructures or open ecosystems. Standards should focus on technologies and not behavioural patterns. They need to be developed together with all stakeholders relevant for the delivery of urban services contributing to inclusive, safe, resilient and sustainable cities and human settlements.

146. Policy learning in a triple helix context approach between science, industry and government is vital. Urban infrastructure and technology demand cooperation among various stakeholders. Next to government, civil society, private organizations and individuals must be given equal opportunity to develop and apply smart solutions and this involves access to information for all. Experimenting with and learning from the social possibilities of new technologies through a "learning-by-doing" approach and urban living labs is also required.

147. Smart city concepts can provide inputs into effective urban services and provision. However, since cities are unique, a careful integration of the smart city concepts into integrated urban development concepts is required to assure that technology supports people and is fit for purpose. This may be guided by an active exchange between cities to avoid mistakes and replicate success.

B. Implementation and finance

148. Clearly defined financial mechanisms should facilitate local authorities' access to financial resources, attract domestic and foreign direct investment, establish and improve revenue generation and collection systems at subnational level, and engage in a transparent and productive way with the private sector. The need to develop and implement monitoring and evaluation mechanisms to monitor progress and document impacts of spatial plans should also be highlighted.

149. Support should be provided to local authorities in developing coherent and implementable urban management tools and parameters (i.e. spatial plans, regulations) in order to provide the territorial framework within which governance

[5] World Business Council for Sustainable Development, The Urban Infrastructure Initiative, Final Report, April 2014.

tax and fee collection, infrastructure provision, environmental management and service provision are prioritized and implemented. This includes expanding and updating the information of the local authorities' cadastre.

150. In addition, progressive tax systems must be introduced to finance infrastructure outside development grants/tax revenues. This ensures a good tariff and structured/tiered rates determined by the quality of the services or the product provided.

National urban infrastructure and transport funds

151. Urban infrastructure funds based on a diversity of funding sources should be developed at the national level. This could include contributions from international funding institutions as well as earmarked revenues from dedicated taxes. Different models could be envisaged for such funds, ranging from grants to public to leverage for contributions from other public entities and the private sector. Eligibility criteria for the funds could include the following:

(a) Prioritization of integrated urban strategies including urban development, housing and public transport; this helps hedge the risks linked to individual projects;

(b) Integrated in reflection at national level on development potential and balance between different cities and regions;

(c) Subject to appraisal procedures set out at national level;

(d) Appraisal based on integration within a sustainable urban transport plan.

Generation of funding for infrastructure and services at local level

152. Frameworks should be developed at national level allowing local authorities to perceive taxes and charges related to value created by investment in transport schemes. In parallel, capacity should be built to provide local governments with adequate tools to capture such value.

153. Partnership should be developed between players at local level to support the acceptability of the measures.

C. Monitoring

154. Monitoring of progress in implementing sustainable urban services policies and infrastructures can help guide and redirect local decisions and share experiences with the global community. The main elements for the monitoring of urban services and technologies are focusing the various urban services sectors. The selection of indicators should build on the upcoming indicator set for the Sustainable Development Goals provided this is developed with local authorities associations and city representatives adequately involved.

Data in support of urban infrastructure and transport policies

155. Data are required to support policy design, setting of targets, and appraisal and monitoring of implementation. Regarding in particular appraisal, only reliable data should be measured that account for the wider benefits of investments in urban infrastructures and services.

156. Capacity-building should be provided for the identification and measurement of adequate input, output and outcome indicators which reflect the reliability of data in its specific national or local context. Appropriate procedures should be developed at local level for collection, management and sharing of data. Analytical frameworks should be established at national/international level for comparisons of data between cities.

VI. Conclusion

An urbanizing world and the crucial role of urban services and infrastructure

157. Urban services are fundamental to human living for all people, in all cities and settlements of the world. In many places, adequate, safe, affordable, accessible and sustainable basic services and infrastructures for all are yet to be realized. The provision of the whole range of urban services remains the driver for social and economic development and the well-being of the urban population, in particular to the most vulnerable, such as the urban poor, women, children, older people and those with disabilities. The urban world becomes highly differentiated; high-technology applications and inadequately low provision of basic services take place at the same time and often physically side by side.

158. Serious disparities prevail between the developed and the developing world regarding the level of service provisioning in general and across groups and communities in particular, especially in Africa. Even in developed countries, the development and/or maintenance of safe, healthy, resilient and sustainable infrastructures is still a major task. Access to urban services is linked to the Sustainable Development Goals and the ambitious goals for climate change mitigation formulated at the COP21 Conference.

159. Global urbanization urgently calls for basic service delivery and infrastructure development as core themes for the New Urban Agenda. In cities, nearly 1 billion slum dwellers are deprived of all basic services, especially in African cities, while urban infrastructure has yet to be constructed for 3.5 billion people. Crucial to this is the rapid development of appropriate policy, governance and funding frameworks. The delivery of services needs to go in line with efficient operation and maintenance practices. The smart use of fast advancing technologies, especially ICTs, can help in this respect.

160. In order to boost the implementation of the New Urban Agenda in the area of urban services and technologies, governance structures are needed that give clear responsibilities to different levels of government, and encourage active participation and engagement of all stakeholders, including citizens and the private sector.

Key actions for each level of government

161. To achieve inclusive, safe, resilient and sustainable human habitats based on adequate urban services, the different stakeholders need to undertake key actions:

National level

(a) National Governments need to provide the mandate and the means to local governments to deliver urban services;

(b) Key national policies that are required include fiscal policies (e.g. energy and fuel taxation), minimum standards for basic services, water safety and recycling, regulation for efficiency, and procurement frameworks;

(c) The provision of funding from national level goes along with conditionalities and appraisal of projects and strategies that require major investments;

Regional and local governments and authorities

(d) Local governments are key to improving urban services and transport. They need to set political priorities and ensure that infrastructure, technology and policies deliver on those priorities. For this to be effective, strong local leadership is needed with a clear vision and support from local businesses and citizens;

(e) Local governments are best placed to establish integrated urban development plans, which bring infrastructure and mobility in line with other local policies and objectives, particularly housing and land use policies. It is essential that the relevant departments coordinate their actions and policy goals. In doing so they can better match demand with ability to deliver services to all;

International institutions

(f) International funding institutions have a key role to play to support local action and to leverage further funding;

(g) International agencies play a key role in facilitating knowledge exchange and providing capacity-building. This can include institution-building, policy and infrastructure development, needs assessment and measurement of impacts.

162. It is necessary to reach a collective agreement on the role of sustainable urbanization within a wider agenda of sustainable development. This cannot be achieved if levels of government act in isolation. They need to adopt a systemic approach on multilevel governance, ensuring that policy priorities are in line and actions are mutually reinforcing in delivering on the New Urban Agenda.

Annex

Case studies

This annex brings together a selection of case studies in the thematic areas covered by Habitat III Policy Unit 9. Given the interdisciplinarity of several of these case studies, there are many overlaps with themes of other Policy Units. Several of these case studies come from the case study series of the Connective Cities project.

Infrastructure including energy

Ahmedabad, India
Connecting 200,000 households in slums to the grid

Ahmedabad is situated in West India. It is the fifth largest and one of the fastest growing cities on the subcontinent. 40 per cent of its 5.6 million inhabitants live in slums and informal settlements, mostly without any public service provision. In 2001, the city initiated a pilot project, connecting 800 households to the electricity grid within three years and removing illegal power lines in streets and homes with the goal to ensure tenure security for slum dwellers and payment of bills for energy companies. In order to accomplish these objectives, the city collaborated with two energy companies and two NGOs. The NGOs (SEWA, a women's association, and the charity organization SAATH) were responsible for information, education and active participation of the 800 households included in the project to ensure buy-in, the project financial viability (also through microcredit), its realistic implementation and its sustainability. They also built confidence and trust between slum dwellers, city administration and private energy companies, the cornerstone for the successful collaboration among the actors involved. The pilot project received financial support from the American development agency USAID.

Experiences made in the pilot phase have motivated the city to expand the programme. From 2004 to 2008, all poor households in Ahmedabad's slums, in total about 200,000, were connected to the grid. The Federal State of Gujarat transferred the idea to other cities, where similar services are now being offered. Meanwhile, the programme has also spread to Mumbai and even to cities on the African continent.

For additional information: http://www.connective-cities.net/en/connect/good-practices/ahmedabad-connects-200000-households-in-slums-to-the-grid/.

Delitzsch, Germany
An energy-efficient City

Situated to the north of Leipzig, the town of Delitzsch has an innovative energy management system using photovoltaics, wind energy and biomass to generate electricity and obtaining heat from geothermal and solar thermal sources. The Delitzsch "Energy-Efficient City" project received an award by the Federal Ministry of Education and Research (BMBF) in 2008 to implement innovative ideas in the energy sector. The current project implementation phase is expected to continue until May 2016.

The goal of the city is to achieve an at least 40 per cent reduction in CO_2 emission levels by 2020 (against 1990 levels). Energetic renovation is to result in improvements in the structure of buildings, enhance the quality of housing and reduce heating costs.

The city has been divided into districts with inhabitants bearing similar socioeconomic features and comparable types of buildings. The development of a software tool supports the modelling of district-related characteristics based on population statistics, data on types of buildings, the state of renovation or the type of energy supply. Networking business, science and technology is also part of the strategy. The role of the so-called "Energy Efficiency Manager" is to bring together relevant actors from the various areas. Owners of landed property, associations, the retail trade, service providers and many other institutions are part of a constantly expanding learning network.

The energy efficiency of the city has increased significantly thanks to the energetically renovated districts of the old city. Delitzsch also serves as a model municipality for further cities in east Germany that have a similar socioeconomic structure and seek to orient themselves on energy-efficient and sustainable urban development.

For additional information: http://www.connective-cities.net/en/connect/good-practices/delitzsch-energieeffiziente-stadt/.

Stockholm, Sweden
The Hammarby District: a closed-loop system integrating water, waste and energy[a]

Hammarby is a new district in southern Stockholm. The district's planning and development dates back to 1996 and will be completed by 2018. First designed to host the 2004 Olympic Games, after a failed bid, the area was subsequently converted, into an ambitious eco-district, along the guidelines of Local Agenda 21 and the Smart Growth theory, with the goal of reducing its environmental footprint by 50 per cent.

As of 2008, compared to the early 1990s, the overall consumption of non-renewable energy, water resources and greenhouse gas emissions revealed significant reductions amounting to 40 per cent. The district's compactly designed environment and the promotion of alternative means of transportation through public awareness campaigns, has successfully encouraged its residents to favour walking over car use for their everyday journeys.

The Hammarby district developed its own integrated water-energy-transport systems Urban NEXUS: the decentralized sewage treatment plant and recycling models are based on the "closed-loop urban metabolism" concept, which promotes the cascading of waste and water resources. The composting of organic waste and sewage sludge produces soil nutrients, while energy recovered from waste incineration and water treatment supplies the district's heating system. Biogas is also recovered through these processes for stoves and buses.

[a] Excerpt from the Hammarby District case study part of the GIZ and ICLEI, 2014, Operationalizing the Urban NEXUS: towards resource efficient and integrated cities and metropolitan regions.

Further, the advanced infrastructure has created the potential for cross-sectoral institutional integration, enabled by the national Local Investment Programme (LIP), allowing the Swedish national Government to financially support municipalities engaging in ecological sustainable development. Stockholm City developed the area through a joint partnership between Birka Energi, the Stockholm Water Company and the City of Stockholm Waste Management Bureau. This approach facilitated the integration and coordination between water, waste and energy sectors while building Hammarby's resource-efficient system, to achieve scaled-up design and technology systems and delivery models.

The district planning and development was underpinned by a strong focus on technological innovation. Affordable housing was however not embedded in the district development. Despite improvement possibilities on the social integration side, the project provides a successful example of brownfield reconversion with integration and high sustainability standards at its core.

For additional information: http://www2.giz.de/wbf/4tDx9kw63gma/20_Urban NEXUS_CaseStory_Stockholm.pdf.

e'Thekwini, South Africa
Communal ablution blocks for informal settlements

e'Thekwini is a metropolitan area comprising the City of Durban and its surroundings. In 2004, the e'Thekwini municipality's Housing, Architecture, Health, and Water and Sanitation Departments jointly came up with the concept for the community ablution blocks (CABs) programme to provide sanitation and water services as well as skills training and job opportunities to the residents of unserved informal settlements hosting approximately 1 million people in the urban and peri-urban areas of e'Thekwini.

The communal ablution blocks (CABs) were designed and installed by the municipality. CABs are mobile modified shipping containers, each having two showers, two flush toilets, two hand basins, four basins used for washing clothes, a small locked storeroom for cleaning materials and outside lighting to improve safety. They are connected to the municipal sewerage and water systems and are installed in pairs — one for women and one for men. To address the potential health hazard of grey water run-off, a vertical garden was designed so that grey water could filter directly to the roots of vegetables. To achieve community buy-in, the e'Thekwini Water and Sanitation (EWS) in partnership with Africa Ahead (NGO), established health clubs among the residents and conducted focus groups to determine what their needs were. People from the community were employed to assist in the installation process and a caretaker is employed to manage each CAB.

More than 800 CABs have been installed, servicing an estimated 500,000 residents of informal settlements. The CABs have become social development hubs, with health clubs, kindergartens, food gardens and play areas, tuck shops and telephone services, contributing to the development of a strong sense of social cohesion within these communities. The key ingredients for the success of the programme were the sound leadership, the working environment and the institutional capacity at the EWS department in the municipality. This allowed the EWS to form creative partnerships with the local ward councillors, NGOs and the municipality, and it enabled each partner to play a very meaningful role in the successful implementation of the programme. The partnership with the University of

KwaZulu-Natal was crucial as the research conducted informed the municipality of possible conflicts and dissatisfaction with the process, as well at highlighting its shortcomings.

For more information: http://www.connective-cities.net/en/connect/good-practices/communal-ablution-blocks/.

Freiburg, Germany
Efficient and sustainable facility management

Like other towns, the City of Freiburg, a university city in the south-west of Germany with a population of just under 219,000 inhabitants, has a considerable real estate portfolio. In order to establish centralized supervision and support of all city-owned buildings regarding constructional measures, energy management, cleaning, operation and letting, the city founded "Gebäudemanagement Freiburg" in 2006. It is responsible for a total of 470 buildings, above all schools, school sports halls, museums and fire stations. City-owned housing and real estate used predominantly for commercial purposes are excluded.

With the aid of an electronic facility management system (CAFM, Computer-Aided Facility Management), the inventory and consumption data of all 470 buildings are captured centrally. Thus "Gebäudemanagement" establishes available area and space in the individual buildings on a continuous basis. A virtual "Tenant-Lessor Model" provides each city institution using a building with regular statements of rent levels and service charges. It is planned to transform these virtual rents into real rents. In addition, the city conducts a long-term cost-benefit analysis in all retrofitting and new construction projects incorporating not only the costs of reconstruction or new construction but also the operating costs over the next 30 to 50 years. This database enables politicians and administrators to supply a better justification of higher investment costs to achieve good quality and high energy-related standards even if that makes the project more expensive in the short term.

Central facility management creates a sound database for sustainable planning of the retrofitting and extension of buildings as well as new buildings of Freiburg's City Administration. It enables the establishment of specific space requirements, comparisons of construction costs, the grouping of procurements and the optimization of energy management. This allowed to significantly reduce material and staff costs for facility management. Thus a reduction of CO2 emission from municipal buildings related to gross floor area by more than 40 per cent has been achieved compared to 1990.

The example of city facility management in Freiburg shows that targeted modifications in the organizational structure of an administration and in its process organization can make a considerable contribution to more cost transparency, cost reduction and a more efficient use of energy in the city's real estate portfolio.

For additional information: http://www.connective-cities.net/en/connect/good-practices/efficient-and-sustainable-facility-management-in-the-city-of-freiburg/.

City level, Indonesia
Improvement of public service delivery by means of public participation in Indonesia

In Indonesia decentralization received a great push forward following a "big bang" approach which was launched in 1999. From 2001 onward most public service functions were transferred to local governments, both cities and districts, now being in charge of education, health and other infrastructure services. Yet hopes for more customer-oriented service delivery did not materialize, given insufficient internal and external control of public administrations' activities, non-transparent procedures and a civil service with inadequate remuneration and lacking incentives for performance improvement. The Indonesian State Ministry for Administrative Reform supported by German development cooperation in 2000 therefore embarked on a process to improve public services by means of public participation, embedding it in the national Five-Year-Plan 2004-2009. The approach addressed two levels: on the one hand guidelines and legal regulations to improve service delivery processes and enhance control of public sector institutions, on the other hand instruments for citizens and civil society to control public sector agencies and officials in pilot regions. One of the latter instruments was the development of a method to interview service users in 15 different service sectors (initially applied in two local governments) with the support of a local multi-stakeholder facilitating team. The results of the survey were entered into a "customer complaint index" and made available to the public. The analysis of complaints distinguishes between complaints caused by the service delivery unit itself, and those dependent on higher-level conditions or institutions. The first types of complaints were addressed directly at the operational level and committed activities to remedy them are published in a "service charter" signed by all officials involved. The second types of complaints were addressed by developing "response recommendations" which are forwarded to decision makers. The experiences gained in the pilot regions were published as manuals on methods and instruments. Repeated complaints surveys in selected local governments confirm that the quality of services and the satisfaction of customers have increased measurably in sectors such as education, health and water provision where improvements were implemented. These outcomes led to a huge demand among other local governments so that until 2009 the survey method and consecutive steps were applied in 485 service provider units in 75 local governments throughout Indonesia. This positive development was enabled by political, legal and financial support provided by the State Ministry for Administrative Reform.

For additional information: http://www.connective-cities.net/en/connect/good-practices/improvement-of-public-service-delivery-by-means-of-public-participation-in-indonesia/.

Heidelberg, Germany
Area-wide passive house standard in Bahnstadt[b]

Bahnstadt, a new district, is arising on the area of the former freight and switch yard in Heidelberg, a university city in south-west Germany (145,000 inhabitants). With its 116 hectares, it is one of the largest urban development

[b] Excerpt from 2014, Energy-Cities, Urban Development and the Passive House Standard — Heidelberg's new Bahnstadt District is Growing Dynamically.

projects in Germany and one of the largest area of passive houses in the world. The Heidelberg Development Company (EGH) was established in order to develop and market Bahnstadt. Its stockholders are Sparkasse Heidelberg, the Heidelberg Housing and Real Estate Company (GGH), and Landesbank Baden-Württemberg.

The course for the sustainable development of Bahnstadt was set by integral environmental and energy concepts. By reusing the freight and switch yard, closed in 1997, this urban development saves a lot of space. Transportation is minimized by the central location of the district which allows for a high percentage of non-motorized traffic. Two thirds of Bahnstadt's roofs will be vegetated to foster nature conservancy, microclimate and rainwater retention. Rainwater from roofs is drained and retained. Hence, discharging into channels is minimized.

Heidelberg's energy conception is the basis for the energy concept of Bahnstadt. It defines high energy standards for municipal buildings, the management of estates, and urban development. In 2010, the energy conception was updated with a focus on the passive house standard. According to the calculations regarding profitability and emissions of carbon dioxide of different types of heat supply, district heating proved to be the most efficient solution due to the urban density — despite the passive house construction — also because the grid can be used as infrastructure for a gradual increase of the share of renewable energies for the heat supply. The first step towards "green district heating" is the construction, by Heidelberg's municipal energy supplier (Stadtwerke Heidelberg) of a co-generation power station using wood next to Bahnstadt. It enables the city to use the renewable, but only limited energy source (wood) efficiently for cogeneration. Completely natural wood is used to cover the entire demand of heat and energy of Bahnstadt. Furthermore, the basic load of Heidelberg's district heating can be covered in summer.

The factor of success for the district Heidelberg-Bahnstadt with its passive houses and zero-emission buildings is the total package of a coherent energy concept, binding planning acts and contractual guidelines, the development of a positive image, specialist counselling in terms of energy, financial support, and sophisticated quality management.

For additional information: http://www.energy-cities.eu/db/Heidelberg_Bahnstadt_2014_en.pdf.

Mexico

ECOCASA: aligning the Mexican housing sector to meet climate challenges

ECOCASA as an innovative financing scheme is helping Mexico to tackle climate change by unlocking financing to build sustainable housing and increasing the amount of mortgages for low-carbon residences. In addition to its many climate and environmental advantages, the activity is bringing about long-lasting benefits to Mexico's housing sector and to its sustainable development in general. Providing financing to build more low-carbon houses will help decrease energy consumption and spending, improve level of comfort of beneficiaries and strengthen government policies. In the first seven years ECOCASA is helping to build 27,600 energy-efficient houses and finance an additional 1,700 "green" mortgages. The Mexican Government has introduced the program in search for new ways to curb greenhouse gas emissions and to increase energy efficiency in the residential construction sector. Currently Mexico's housing sector already accounts for about 16 per cent of

total energy use and 26 per cent of total electricity use. The energy demand, however, is expected to increase even further with rapidly expanding cities and inefficient transport patterns. ECOCASA is thought as a measure to counter that trend. The program provides financial incentives and technical assistance to housing developers so that they adhere to new energy efficiency standards, which are aimed to transform the Mexican residential housing sector in line with the national climate change strategy. These houses, built mostly for low-income families, incorporate technologies to reduce their carbon footprint resulting primarily from reduced energy consumption. Among these modern technologies is the insulation of roof and walls, the usage of reflective paint, efficient gas boilers, efficient refrigerators, or energy-saving windows. These houses will reduce greenhouse gas emissions by at least 20 per cent compared to regular ones.

ECOCASA is a joint initiative of Sociedad Hipotecaria Federal (SHF), the Inter-American Development Bank (IDB) and the German development bank KfW within the framework of the Mexican National Appropriate Mitigation Action for Sustainable Housing (NAMA), which was launched by the Government of Mexico at the Climate Change Conference in Durban, South Africa, in 2011. ECOCASA receives financial support from the IDB (out of its own resources as well as from the Clean Technology Fund — CTF) as well as the German Ministry of Economic Cooperation and Development (BMZ) and the European Union's Latin American Investment Facility (LAIF) both administered by KfW. The project has been recognized by UNFCCC as a model project in their 2013 Momentum for Change awards.

For additional information: http://cld.bz/BfGB4je#8 and http://unfccc.int/secretariat/momentum_for_change/items/7848.php.

Bottrop, Germany
InnovationCity Ruhr — Model City Bottrop: revitalizing an industrial region through low-carbon redevelopment and active public-private partnerships[c]

Bottrop is a city of 117,000 inhabitants in the Ruhr region with deep roots in coal mining and industry — both economically and culturally. However, structural economic changes due to globalization since the 1970s, coupled with higher environmental standards and policies in Germany since the 1980s, have initiated a post-industrial redevelopment in Bottrop and the entire metropolitan area of Ruhr.

These processes are intrinsically interconnected with one another and pose significant adaptation challenges to both public and private interests. Bottrop was selected as pilot city (Model City Bottrop) by the Ruhr Initiative Group for its "InnovationCity Ruhr" programme with the goal of enhancing overall quality of life and reducing greenhouse gas emissions by 50 per cent by 2020. The "blueprint" for Bottrop's redevelopment focuses on energy efficiency and renewables in both commercial and residential areas, with measures for environmentally friendly mobility and adaptation of urban space for increased quality of life for its residents.

The City of Bottrop chose to drive the "Model City Bottrop" project management and coordination forward through the founding of a private company, InnovationCity Management GmbH, composed of five key public and private

[c] Excerpt from 2014, ICLEI, ICLEI Case Study 169: Bottrop, Germany.

shareholders. The company serves as a platform and facilitator to bring together all stakeholders and foster new partnerships and networks.

To achieve the goal of a significant reduction in CO2 emissions, a systematic energy efficient retrofitting of existing buildings was necessary. Since November of 2011, InnovationCity Management has offered individualized energy consulting to both households and businesses through their Centre of Information and Advice (Zentrum für Information und Beratung — ZIB) which analyses energy consumption data and develops customized retrofitting proposals. Through the extensive consultation efforts towards homeowners an outstanding energy refurbishment ratio of 7.82 per cent was achieved in 2013, outperforming by far the common European and German average rate of energy efficient retrofitting of about 1 per cent.

Since October 2012, InnovationCity Management — together with its local consortium and strategic partners, worked on the creation of an exportable "blueprint" alias "master plan" as an example of successful climate-friendly urban redevelopment. Central to Bottrop's development blueprint is the active role of the community within projects and the bottom-up approach to implementation. Following InnovationCity Management's collection of numerous suggestions for the redevelopment of the seven pilot districts through citizen planning workshops, multi-stakeholder district management committees were established.

In each of Bottrop's pilot districts, a district manager coordinates the integration of all activities, namely: urban renewal, energy efficient retrofitting, historic preservation, energy consulting and social considerations. In addition to consulting building owners, tenants and businesses, district management committees are also actively involved in outreach to schools in topics of environmental and climate education in cooperation with universities of applied sciences.

For additional information: http://www.icruhr.de/fileadmin/media/downloads/ICLEI_cs_169-Bottrop_2014.pdf.

Mobility

Medellín, Colombia
Metrocable — mobility as fundamental factor of integrated and inclusive urban development

The city of Medellín stretches from a narrow valley to vast areas on hilly slopes. The latter settlements often resulted from informal settling processes are characterized by insufficient transport, low presence of State institutions and lack of public services which inhibited development and employment opportunities for residents and produced physical and social marginalization of those districts.

Since the start of the millennium, the local government has initiated comprehensive and integrated interventions in order to upgrade the districts in collaboration with their communities.

In 2004, Medellín opened the first cable car route (Metrocable line K) as part of a public transport system worldwide. It reaches around 230,000 inhabitants in 12 localities and links the city's north-east with its centre. It reduces the average transfer time from 120 to 65 minutes. This gondola lift is supported by the

municipality and embedded in an integrated urban development programme focused on equal access to mobility. Integration to Medellín's public transport system through the cable car increases comfort and reduces expenditures on time and costs. Particularly low-income customers save money because they pay per ride, independently from the distance travelled. The "Civic Card", a rechargeable swipe card, reduces waiting time since commuters can pay for their rides in advance. Moreover, the project provided for investments in a public library, kindergartens, public space and sports facilities. Inter-institutional cooperation promotes the planning and development of comprehensive concepts, meanwhile known as "social urbanism". The second cable car route was inaugurated in 2008. In 2011, the metro system was complemented by Metroplus, a bus-rapid-transit. Its large, energy-saving buses use separate bus lanes, similar to a metro or tram.

Introducing the Metrocable and connecting marginalized areas were the starting point for a physical and social transformation of Medellín and its communities. The formerly excluded population is now more included in the city's social, economic and political life. They also participated in the decision-making on future urban development projects. Meanwhile, the newly connected neighbourhoods have been upgraded noticeably: local businesses have settled and crime rates went down.

For more information: http://www.connective-cities.net/en/connect/good-practices/medellins-metrocable/.

Curitiba, Brazil
A model of transit oriented planning[4]

The City of Curitiba is the capital of the Paraná state in southern Brazil. The city has a population of 1.9 million people within an area of 430 km². Since the 1970s, Curitiba has integrated public transportation planning into the overall city plan. In 1972, Curitiba created one of the world's first pedestrian malls in order to reduce vehicle traffic in a busy area. Today, public transportation is the priority in Curitiba's long-term structural plan for urban development. Curitiba is regarded as an excellent example of transit-oriented development (TOD), which implies that residential, business and recreational areas should be built in high-density areas and close to public transport stations. In addition, rather than promoting segregated zoning of land uses, TOD proposes land-use mix to reduce the travel distances. By coupling the development of a pedestrian-friendly community with an efficient low-emissions bus-rapid-transit (BRT) system and lower car parking availability, Curitiba has successfully reduced the overall travel of its residents. The BRT system in Curitiba has set an example for successful public transportation worldwide. The system currently contains 390 bus routes with 2,000 vehicles that are used for approximately 2.1 million passenger trips daily, nearly 50 times the number of travellers 20 years ago. After its construction in 1974, the BRT gained an annual ridership of 2.3 per cent of the population for over 20 years. Based on a survey of travellers, it is estimated that the BRT system has led to a reduction of approximately 27 million car trips every year, which translates to nearly 27 million litres of fuel saved yearly. The bus system has transformed into a mass transit

[4] Excerpt from 2011, ICLEI, EcoMobility Case Story, Curitiba, Brazil: A model of transit oriented planning.

system with features such as exclusive priority lanes, free transfers between routes, pre-board fare collection, information displays and traffic signal priority.

The modal share of Curitiba is approximately 23 per cent private vehicles, 5 per cent motor bikes, 5 per cent bicycles, 21 per cent pedestrians, and 45 per cent BRT. BRT has a very high capacity, a necessary element given the size and expansion of the city. In one BRT lane, 10,000-20,000 passengers can be carried at one time, with a capacity of 40,000 passengers on busy roads. BRT is used by 85 per cent of Curitiba's population. The public transportation system is exceptional in terms of its affordability for customers, the use of enclosed prepay stations, and the integration of transfer terminals.

For additional information: http://www.iclei.org/fileadmin/PUBLICATIONS/Case_Stories/4._EcoMobility/ICLEI_CaseStories_EcoMobility_Curitiba.pdf.

Smart Cities

Jamalpur Pourashava, Bangladesh
E-governance in municipal administration: bringing services closer to citizens

Under the motto "Vision 2021: Digital Bangladesh", Bangladesh has been intensifying its use of modern information and communication technology. The aim is to make municipal services more effective and citizen-oriented and to curtail corruption. Several municipalities started digitizing their administrative processes. The German Development Cooperation has been supporting the project since its inception and accompanied two e-governance pilot projects in the municipalities of Narayanganj und Jamalpur from 2011 to 2013. In both cities, inhabitants were invited to participate in discussions in order to clarify demands and ideas for public services. Three main innovations were generated: the establishment of one-stop service centres (OSCC), where citizens have access to all municipal services in one place; the development of a municipal information management system, enabling a more transparent, efficient and faster administrative processing; the creation of a public website integrating social media elements to inform citizens and to start a dialogue.

The processes and innovations introduced have been evaluated positively by all stakeholders, including citizens, administration employees and mayors. Services are delivered much faster and in a more effective manner. Staff has been trained in IT, which reduced reservations against modern media. Meanwhile, communication via e-mail and social media has become natural for many, including elderly employees. Investments in improving administrative processes paid off in both cities. The OSCCs run profitable and were able to increase non-tax-based revenues in the municipalities. They are being replicated all over the country.

For additional information: http://www.connective-cities.net/en/connect/good-practices/e-governance-in-municipal-administration/.

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